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AND

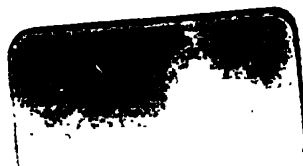
DUD DUDLEY,

ON THE MANUFACTURE OF IRON.

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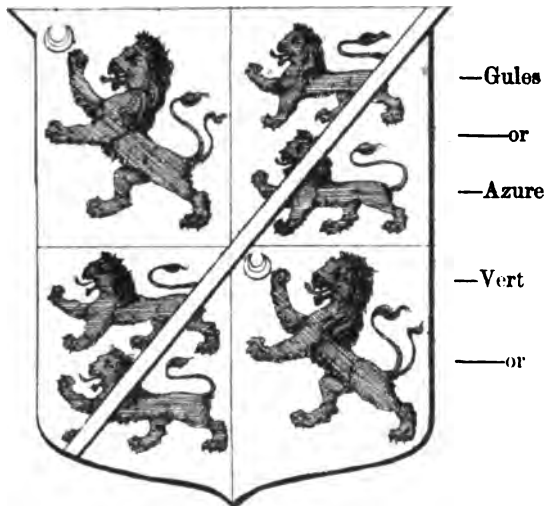
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1 & 4 Sutton al's Dudley.  
2 & 3 Someri Lord Dudley.

- |   |               |   |   |  |  |                          |   |
|---|---------------|---|---|--|--|--------------------------|---|
| 1 | Rc<br>N<br>ir | 2 Jane Wife<br>of Richard<br>Parkshouse,* of<br>Sedgley, in Co.<br>Staff. | 3 Catharine Wife<br>of Thomas Dudley,<br>of Tipton, in Com.<br>Staff. | 4 Alice Wife<br>of George<br>Guest, of the<br>Hole in Co.<br>Wigorn. | 5 Dorothy Wife<br>of Thomas Brookes<br>of Sedgley, in Com.<br>Staff. | 6 Susan<br>died<br>young | 7 Martha Wife<br>of Thomas<br>Wilmer, of<br>Dudley. |
|---|---------------|---|---|--|--|--------------------------|---|

He was one of the Esquires  
Sir Ferdinando Dudley,  
here he was made Knight  
the Bath, & died Ao. 1626.

(Signed) *Dud Dudley*

The above written Pedigree is faithfully extracted from the  
Herald's Visitation of the County of Stafford, made in the  
Year 1663, now remaining in the College of Arms, London.

GEO. HARRISON,

WINDSOR HERALD.

# **Dud Dudley's**

*Mettallum Martis:*

OR,

## **I R O N**

MADE WITH

**Pit-coale,**

**Sea-coale,**

**&c.**

And with the same Fuell to Melt and  
Fine Imperfect Mettals, and Refine  
perfect Mettals.

LONDON, Printed by T. M. for the Author.  
1665.



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*The Publisher to the Reader.*

THE "METALLUM MARTIS" first published in the year 1665, has become so scarce that few copies can be met with. A curious MS. note on the title page of the one preserved in the British Museum, most probably in the handwriting of Sir John Pettus, Knight, of Suffolk, and one of the deputy Governors of the Mines royal anno 1641, to whom the volume belonged, states, that "1000 were paid for, seller cheated of mani by Ironmasters h [ton]" (query Wolverhampton?).

The first reprint was published in 1851, but the whole edition being speedily sold, and many copies still applied for, the editor thought it would be advisable to issue a second edition, together with the "Metallica" of Simon Sturtevant, published in 1612, and that of Rovenson printed in 1613, both of which works are referred to by Dud Dudley. The two above-named books are reprinted from the copies in the British Museum; and, as they contain much curious information about the making of Iron with Pit Coal, their several Authors having obtained Patents for this mode of manufacture from King James First, they will not be unfit companions for the "Metallum Martis."

The late W. Baldwin, Esq., of the Ellowes, Sedgley, had a MS. copy of Dud Dudley's book, which he kindly lent to the editor. It is, however, very imperfect, many pages are wanting, and it has evidently been transcribed without due care and attention. Mr. Baldwin stated that it was given to him, about thirty years since, by Mr. Aston, of Coalbrookdale, Salop. The original MS. is said to be still in existence at Himley, where indeed it was seen not many years since, through the kind permission of the late Lord Dudley, by Mr. Gibbons, of Shut End—now deceased. Cornelius Cartwright, Esq., of Dudley, has an original copy of this work, but half of the map at the end is missing. The editor's best thanks are due to Mr. Cartwright for the loan of his volume, which has been most serviceable.

The annexed short pedigree will shew the family of Dud Dudley. His will has been searched for, but without success, in order to endeavour to trace out his direct descendants. The Parish registers at S. Helen's, Worcester, might have thrown some light upon this subject, but the fees demanded would have been far too great to have justified a search. The following is a copy of the inscription on the family monument

in S. Helen's Church, to the memory of Dud Dudley and his wife, taken from Nash's Worcestershire, vol. 2, app. 149.

CHURCH OF S. HELEN.

On a large monument fixed to the south wall, in two columns.

"Pulvis et umbra sumus  
memento mori."

(1st column). Dodo Dudley chiliarchi nobilis Edwardi nuper domini de Dudley filius, patri charus et regiæ Majestatis fidissimus subditus et servus in asserendo regem, in vindicando ecclesiam, in propugando legem et libertatem anglicanam, sæpe captus, anno 1648, semel condemnatus et tamen non decollatus, renatum denuo vidit diadema hic inconcussa semper virtute senex.

Differt non aufert mortem longissima vita  
Sed differt multum cras hodieve mori.  
Quod nequeas vitare, fugis:  
Nec formidanda est."

(2nd column). "Hic jacet Eleonora uxor predicti Dodonis Dudley: daughter of Francis Heaton (by Mary his wife, daughter of Francis Dingley of Charlton) son of Francis Heaton and grandson of George Heaton, lord of the manor of Winkell, in Lincolnshire, who married Joan, one of the coheirs of Sir Robert Byfield—(the rest married to Byron Molyneaux and Sir Miles Bushley). William Heaton his grandfather married Sir George Merry's daughter, of An Bright in Lincolnshire. She was born 1601, the 25th of December, at 6 of the clock, 4 Ser. P M. pol. 52. 24. died 1675, Decemb. 3, at 3 of the clock.

Mors omnibus instar,  
Nec fugienda tibi.  
Chare viator hodie mihi conjugii,  
Cras tibi marito meo."

Underneath, ten besants with these words.

"Non spirans sperabo."

On the top, a lion rampant imp. six trefoils slipped. Lower. Parted per chevron Or and Azure, three roundles counterchanged impaling Azure a chevron ermine cotised Argent, between three Martlets Or. [This monument is now destroyed]

JOHN N. BAGNALL.


WESTBROMWICH,

DECEMBER, 1854.

TO THE  
**K I N G S**

**Most Sacred Majesty.**

*May it Please your Majesty,*

 *All Your Kingdoms, Dominions, and Territories, being the happy Subjects of Your Cares, are therefore the proper Objects of Your View: Great Brittain, O Great Brittain, Your Principal Island, here Humbly Presents her self unto Your Royall Presence, View, and Care; be Pleased, to interpret this her Obsequiousness, to be her Duty; for since Your Majesties safe Return, has already Graciously dayned, to View, and often to review her Shipings, Stores, Armories, Ordnance, Magazines, and Trade; Vouchsafe, Great Sir, Great Brittain Your Royal Patronage, and once more,*

*at some one hour, or two, to Grace it with Your Auspicious Aspect, in this Mite, with all Humility Presented, By,*

**A Faithful Servant, of Your Sacred Fathers;**


**And a Loyal Sufferer, for Your Sacred**

**Majesty; And by**

**Pattent-Servant,**

***Dud Dudley.***

T O T H E  
**Honourable, His Majesties Great**  
Council,  
*The High Court of Parliament.*

 Our Predecessors in former Ages, had both serious Consultations, and Considerations, before they made those many Wholesome and Good Lawes, for the Preservation of Wood, and Timber, of this Kingdome, 1 *Eliz.* 15. 23 *Eliz.* 5. 27 *Eliz.* 19. 28 *Eliz.* 3. 5. in whose dayes, and since in King *James's* Reign, Ships in most Ports and Rivers of this Kingdom, (*Thames* Excepted) might have been built, for forty Shillings *per* Tunn; but now they can hardly be built for treble the value, wood and timber is so much decayed; therefore men of War, Trade of Merchants, of Fishing, of Navigating, unto Plantations will decay, if not timely prevented, which is hoped will be one of Your Principallest Cares, seeing our Enemies have carried Timber from *England*, and the Iron Works have much exhausted it; For the prevention of so great a Consumption, almost incurable: First is to put the Wholesome Laws in Execution;

A 3

*The Epistle.*

cution ; Secondly, not to permit Timber to be Exported. Thirdly, to animate, as King *James* did, and also Prince *Henry*, the making of Iron in *England*, *Scotland*, and *Wales* with Pit-cole, Sea-cole, and Peate : which if the Author (who had a Pattent for it) had not been opposed, after he had made much good Iron with Pit-cole, it had long since, by his Inventions, been fully perfected. The Fourth is, to stop all the Exportation of Pit-cole, and Sea-cole (paying His Majesties Duty) if the Cole be in a fit place, to make Iron therewith. Fifthly, That the Authour, or his Agents may have power to preserve many thousand Tuns of Pit-cole, which are annually destroyed, for ever in *England*, *Scotland*, and *Wales*, which are fit to make Iron ; and the Authour in this Treatise hath demonstrated it being moved with pitty, seeing his Native Country decaying, Humbly offers but his Judgement, and leaves the grave consideration thereof, to your Learned, and more serious Consultations and Actings, praying that you may animate good things, and new inventions, that may bring unto His Sacred Majesty, and all Loyal Subjects, Safety, Strength, Wealth, and Honour by our Ships, and Men of War, Fishing, Navigation, and Merchandizing, unto Forreign Nations ; but more especially, to and from the Territories of *Great Brittain*, our *North Indies*

*The Epistle.*

*Indies* abounding in *Mines* and *Minerals*, that they that are of the Honourable Corporations of *Mines Royal*, and *Batteries*, or any others, would lay in a Common, or Joynt Stock, fully to set the *Mines* at Work, by imploying our idle, and burdensom supernumerary people therein, *Iron*, *Tin*, *Lead*, *Copper*, *Quick-silver*, *Silver* and *Gold*, besides many other *Minerals*, and *Marcesit's*, *Lapis Calaminaris*, *Antimone*, *Maganes*, &c. also many *Mineral Earths* and *Precious Stones*: Did I call *Great Brittain* our *North Indies*? give me leave to repeat a passage till further satisfaction, of King *Josina* of *Scotland*, a great Philosopher, Physitian, and Herbalist, living before Christ, 161 years, at which time, two venerable Philosophers and Priests passing from *Portugall* to *Athens*, their Ship and Company, and Marriners, all perished at *Ros*, they only saved; after refreshing, and good Entertainment, the King desired of them what they understood by their Science of the Nature of the Ground of *Scotland*; after deliberate advisement, said, *There was more Riches and Profit to be gotten within the Veins of the Earth of Scotland, then above, for the winning of Mines and Metals; They knew this by the Influence of the Heavens*: This you may see in the *Chronicles of Scotland*.

My Dear Master, our Sacred Martyr, *Charles* the

*The Epistle.*

First of ever Blessed Memory, did animate the Author by Granting him a Pattent, *Anno* 14 of His Reign, for the making of Iron, and Melting, Smelting, Extracting, Refining, and Reducing all Mines and Metals with Pit-cole, Sea-cole, Peat and Turf, which was Extinct, and Obstructed by reason of the War; and had not this unnatural and unparallel'd War been, His late Sacred Majesty himself had set at work many of His Mines, and much good had been produced to *Great Brittain* before this time.

At present, the Authour is in good hope, and incessantly prays, that the Mines be set at work in his dayes, by the Honourable Corporation of the Mines Royal, for he verily believeth the time to be near, when the Omnipotent God, before he Judge the World in Fire, will shew His Omnipotency unto the *Nations*, by revealing of the wonderful and incredible things of Nature, of which the Learned do believe very many to be, in the Mineral Kingdome, by working of Mines and Fusion of Metals, gotten by honest labour under ground, profitable to Man, and Acceptable with God. I might here speak somewhat of Superiour Planets producing Metal, *Saturn*, Lead: *Iupiter*, Tin: *Mars*, Iron: but these abound in *Great Brittain*, so do the Inferiour Planets produce *Venus*, Copper: *Mercury*, Quicksilver: *Luna*, Silver.

If



### *The Epistle.*

If God permit me health and leasure from Sutes and Troubles, not onely to write of them, but also the manner of the Melting, Extracting, Refining, and Reducing of them with Pit-cole, Sea-cole, Peat, &c. In the interim to let you know that *Great Brittain* abounds with *Copper Mines*, much neglected, yet of great use for Ordnance, at Land, and also at Seas, and for the making of Brass, with our *Lapis Calaminaris*, so much Exported by the *Dutch*, which doth hinder our manufactories of Brass, and causes the *Dutch* and *Swedes* to raise the price of Copper and Brass ever since our small loss at Sea by the *Dutch*. *Mercury*, Quicksilver is not wanting, but few Artists have made any Experiment of that Mine in this Kingdom.

*Luna*, Silver doth abound in *Great Britain*, especially a very Rich Vein, Rake, or Fibrey thereof was wrought at *Binny-hills* near *Lithgo* in *Scotland*, in the Authors dayes, some part of which he hath, is malleable Silver in the Oare or Mine, yet neglected. And so are many of our richest Mines in *England* and *Wales*, &c. the cause is conceived to be the want of a general and joynt-stock for the imploying our idle people in getting, and working of the Copper, and Silver Mines.

Of the Planet *Sol*, Gold: I may not be silent,  
whose

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whose Golden, Glorious, Pure, Sulphurious, Percing, Spirit, communicating his virtue Mineral unto all things in the Mineral Kingdom, as well as to the Animal and Vegetable Kingdom, whose pure influence producing Gold, caused the poor indigent people of *Scotland*, which the Author did see, *Anno 37*, at *Shortlough*, six men to dig and carry with wheele-barrows, the common Earth or Mould unto Rivolets remote, out of which those men did wash Gold-grains, as good as in the sand of the Rivers, in which Rivers many have gotten Gold, and seen grains of *Sol*, near one ounce weight, both in the *Low-lands*, and in the *High-lands*; also he hath seen Gold gotten in *England*, but not so plentiful as in *Scotland*: For Sir *James Hope*, *An. 1654*, brought from *Scotland*, Baggs of Gold Grains unto *Cromwell*, some of which Grains were very large, and as fine as any Gold in the world, that is in Mines; thus I came to see the Baggs, taking a view of the *Low-lands*, and *High-lands* of *Scotland*, *Anno 37*, in which year, I spent the whole Summer (in opening of Mines, and making of discoveries) was at Sir *James Hopes* Lead Hills, near which I got Gold, and he coming to *London*, employed Captain *David Acheson*, a Refiner, whom I met with in *Scotland*, *Anno 37*, to find me out; when I came unto Sir *James Hope*, dwelling in *White Hall*, he produced  
the

*The Epistle.*

the Baggs unto me, and poured the Gold out upon a board, in which was one large piece of Gold, which had to it adjoyning a large piece of white spar very transparent, which Cap. *David Acheson* yet living at *Edenburgh* saw; but I would never Act with Sir *James Hope*, hoping of these times to see good things acted, for I believe God is about to reveal many of his secrets, unto his Israel in this latter Age, which made me not to Answer the Letter of Sir *James Hope*, as followeth.

Edinburgh, 26. June 1654.

Sir, *If I had found the opportunity before my parting, I purposed to have been a sutor to you, and I perswade myself, you are so kinde and generously disposed, that you would have answered my desire, and therefore also even at this distance adventure to offer it: And it is that you would confer upon me one breviate of your journey through the North of Scotland; as to the discovery of Minerals upon some account, and at first view, this may seem as unreasonable of me desired, as improbable that you should grant it, but the circumstance of time and persons and substance of the things considered, I am not altogether out of hope of it; onely, I shall say, if you condescend to me in this, though it be more in satisfaction, to my curiosity, then for any designe I have upon the matter; yet you shall singularly oblige me to indeavour and be ready*

B

as

*The Epistle.*

*as opportunity shall offer, to expresse my thankfulness, in  
what way you will prescribe, that is in the power of;*

your very affectionate brother

and Servant, *James Hope.*

*This Sir James Hope, was a Judge at the City of Edinburgh, and by Cromwel made Lord Marshall of Scotland.*

My hope now is, that the Honourable and ingenious Corporation of the Mines Royall, will set the Mines at work, that my Inventions, in which I have spent much time and charge, in melting, smelting, extracting, refining and reducing of Mines and Mettals with Pitcoal, Seacoal and Peats; and have made with the same Fuell many hundred Tuns of good Merchantable Iron, into cast works and Bars; may by the inventioner be enjoyed according to the Act of Parliament, 21. *Jacob.* Seeing the Authour can make it appear he hath been much obstructed by lawsuits and the Wars hitherto: Desires that his Talent of Undoubted truths (may not be buried) for the general good, but be brought to light, after all the sad Sufferings of the Authour, whereby he may add unto his new Inventions, what he conceives fit to be done: That not onely this so exhausted Kingdome may enjoy the benefit thereof, but also *Scotland and Wales* which

*The Epistle.*

which abound with Coals, Iron, Stone and Mines of all sorts, minerals and precious Stones, &c.

Yet from *England's* Granery, *Scotland* making no Iron, and other Territories, have their thorow supply, not onely of Iron, but of Iron manufactories many, so hath *Wales*; yet might *Scotland* and *Wales* not onely supply themselves, but supply His Sacred Majesties other Territories with Iron and Iron Wares and Steel also, by Iron and Steel made with Pit-coale, Sea-coale and Peat; and thereby be helpfull unto themselves and *England*, and all Plantations of his Majesties, on this side and beyond the line. To

To the Reader, especially of *England, Scotland*  
*and Wales.*

**T**He injury and prejudice done unto me & to this Island, my native Country for the making of Iron, in cast works and bars with Pitcoal, Seacoal, Peat and Turff, and with the like feuell, to melt, extract, refine and reduce all Mines and mettals, moved me in the negligence of better Wits and Pens to apologise for it; in this ensuing Treatise, and believe me Reader, twas no private, or politick designe in my Invention, but meer zeal, becomming an honest man, Patriæ, parentibus and amicis; that Engaged me (after many others failed) in these Inventions, for the general good and preservation of Wood and Timber, which,

Eque pauperibus, locupletibus, eque,

Eque neglectis pueris senibusq; nocébit;

Therefore it concerns His Sacred Majesty, his high Court of Parliament, all his Counsels, Mariners, Merchants, Royall and Loyall Subjects (the destruction of Wood and Timber) to lay it to heart, and helping hands, upon fit occasions, in these so laudable Inventions of making Iron & melting of mines and refyning of them with Pitcole, Seacole, Peat, and Turf; for the preservation of Wood and Timber for maintenance of Navigation, men of War, the Fishing and Merchants' Trade, which is the greatest strength of Great  
Brittain

### *The Epistle.*

*Brittain, and all other his Majesties Kingdomes and Territories, whose defence and offence next under God, consists by his sacred Majesties assisting care, and view of his men of War, Ships, experienced marrinours, merchants, Ordinance of Copper, Bras and Iron Armories, Steels, and Irons of all sorts; both of bars, squares, and cast works and which ought and may be suplyed from Scotland and Wales by Iron, Copper, and Brasse, and made there, with Pitcole, Seacole and Peat; and whtch abound there and in England, also, In Cornwall, Devonshire, Sommerset, Gloucester, Stafford, Darby, York, Lancaster, Westmerland, Cumberland; are many Copper mines: so is there in Pembrook, Carmarthin, Merionith and Denbyshires, also there are very many rich Coper mines in very many places in Scotland, at Sterling, at Dumfad and many other places well known unto the Authour.*

Dud Dudley.

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**Dud Dudley's**  
***Mettallum Martis.***

\*\*\* Hat *Great Britain* with her Men of Warr,  
 \*\*\* T \*\*\* Fleets and Shiping, have had in all Ages,  
 \*\*\* and in these latter Ages, as great Success  
 at Seas as any people whatsoever in the Universe,  
 cannot modestly be denied in 88, overthrowing that  
 Invincible Armado so long a preparing, and since  
 other Navies also; and whose Armadoes, Navies,  
 Armes, and Men, have been a Terrour to other  
 Nations; nay her own Grand Magazins, are the  
 very Granary from whence all His Sacred Majesties  
 Kingdomes, Dominions, and Territories both in the  
*East* and *West-Indies*, on this side and beyond the  
 Line, they have their whole and thorow supply of  
 Shiping, Men, Armes, Food and Rayment, and more  
 then can be, from any Kingdom of the Christian  
 World.

Now if Wood and Timber should decay still, and  
 fail, the greatest Strength of *Great Britain*, her Ships,  
 Mariners, Merchants, Fishings, and his Majesties  
 Navies, and Men of War, for our Defence, and  
 Offence



Offence would fail us, which before, and since 88 made his Sacred Majestyes Prodecessors, Queen *Elizabeth*, and her Great Council, the then Parliament, to make Lawes for the preservation of *Wood* and *Timber*, especially near any Navigagable River; 1 *Eliz.* 15. 27 *Eliz.* 19. 28 *Eliz.* 3. 5. 23 *Eliz.* 5. All which Laws, and others, for the Preservation of Wood and Timber are still in force, but not duly Executed; also King *James* His Sacred Majesties Grand-father, and *Prince Henry* for the Preservation of Wood and Timber in this Island, did in the 9<sup>th</sup> Year of His Reign, Grant His Letters Pattents of Priviledge unto *Simon Sturtevant*, Esq.; for 31 years, for the making of Iron with Pit-cole and Sea-cole for the preservation of Wood and Timber of *Great Brittain* so greatly then consumed by Iron-works; This Invention was by King *James's* command to be at large put in Print, which Book did contain near a quire of paper in quarto, called, *Simon Sturtevant His Metallica. Anno. 1612. May 22.* Printed by *George Eld*, Cum Privilegio.

After *Simon Sturtevant* could not perform his making of Iron with Pit-cole or Sea-cole, according unto his Engagement, King *James*, and *Prince Henry*, caused him to render up his Pattent, and a new Pattent was Granted unto *John Rovenson*, Esq. who also was En-joyned

joyned to write a Book of his Inventions, called, *Rovenson's Metallica*. Printed for *Thomas Thorp*, *Cum Privilegio*: May 15. An. 1613.

After *John Rovenson*, Esq. had often failed with his Inventions, and great undertakings, *Gombleton*, Esq. a Servant of Queen *Ann's*, undertook (by Patent) to perform the Invention of making of Iron with Pit-cole, and Sea-cole; but he being as confident of his Invention as others, did Erect his works at *Lambeth*, which the Author view'd; and *Gumbleton* failing, the Learned and Ingenious Doctor *Iorden* of *Baths*, the Authors Acquaintance, and sundry others obtained Pattents for the making of Iron, and melting of Mines with Pit-cole and Sea-cole, for the preservation of Wood and Timber all which Inventions and endeavours to Effect and Perfect the said Works, have been by many heretofore well known, to have worthily attempted the said Invention, though with fruitless success.

Having seen many of their failings, I held it my Duty to endeavour, if it were possible to Effect and Perfect so laudable, and beneficial, and also so much desired Inventions, as the making of Iron into cast Works and Bars; and also the Melting, Extracting, Refining and Reducing all sorts of Mines, Minerals and Metals, with Pit-cole, Sea-cole, Peat, and Turf,  
for

for the preservation of wood and timber, so much exhausted by Iron Works of late.

Having former knowledge and delight in Iron Works of my Fathers, when I was but a Youth; afterward at 20 years Old, was I fetched from *Oxford*, then of *Bayliol* Colledge, *Anno* 1619, to look and manage 3 Iron Works of my Fathers, 1 Furnace, and 2 Forges, in the Chase of *Pensnet*, in *Worcester-shire*, but Wood and Charcole, growing then scant, and Pit-coles, in great quantities abounding near the Furnace, did induce me to alter my Furnace, and to attempt by my new Invention, the making of Iron with Pit-cole, assuring my self in my Invention, the loss to me could not be greater then others, nor so great, although my success should prove fruitless; But I found such success at first tryal animated me, for at my tryal or blast, I made Iron to profit with Pit-cole, and found *Facere est addere Inventioni*.

After I had made a second blast and tryal, the fesibility of making Iron with Pit-cole and Sea-cole, I found by my new Invention, the quality to be good and profitable, but the quantity did not exceed above 3 Tuns *per* week: After I had brought my Invention unto some perfection, and profitable, doubted not in the future to have advanced my Invention, to make quantity also.

C

Immediately

Immediately after my second tryal, I wrote unto my Father what I had done, and withall, desired him to obtain a Pattent for it from King *James* of Blessed Memory; the Answer to which Letter I shall insert, only to shew the forwardness of King *James*, in this his much animating the Inventor, as he did both *Simon Sturtevant*, *John Rovenson*, Doctor *Iordanie* and others; The Letter follows;

Son *Dudley*,

*The Kings Majesty being at New-Market, I sent Parkes thither on Saturday to some Friends of mine, to move the Kings Majesty for my Pattent, which be coming on Sunday Morning, in the Afternoon His Majesty sent a Warrant to Master Attorney to dispatch my Pattent, for the which I am infinitely bound unto His Majesty, that it pleased Him of His Great Grace and Favour to dispatch it so soon; I have been this night with Master Attorney, who will make hast for me; God Bless you, and Commend me unto all my Friends:*

March 10.

Your Loving Father,

1619.

*Edward Dudley.*

This *Richard Parkes*, a *Parks-house Esq;* in the Letter before mentioned, was the Authors Brother in Law, which did about 1 year after the *Pattent* was granted, carry for the Author much good Merchantable Iron unto the *Tower*, by King *James's* command

mand to be tryed by all Artists, and they did very well approve of the Iron, and the said *Parkhouse* had a fowling Gun there made of Pit-cole Iron, with his name gilt upon the Gun, which Gun was taken from him by Colonel *Levison* Governour of *Dudley* Castle, and never restored.

The said *Richard Parkhouse's* son my Nephew, *Edward Parkshouse*, the 5th. of *Januaay* 1664, pressed me much to put Pen unto Paper, to shew what I have done in the invention of making of Iron with Pitcoale and Seacoal, not unknown unto this Country, and to my brother *Folliott*, Esq; and my Nephew *Parkshouse*, Esq; and to my Kinsman Master *Francis Dingley*, to whom I intend to leave the Secrets of my Inventions, notwithstanding all my sad sufferings from time to time this forty Years in the invention, my Sufferings in the War, and my Estate sold for my Loyalty; and also my sad sufferings and obstructions since his Sacred Majesties happy Restauration many wayes; and also upon sundry and many references, at the Authors very great charge, pains, and time spent of Foure years in his aged dayes, for the general good, by his inventions for the preservation of Great *Brittain's* Wood and Timber.

Now let me shew some Reasons that induced me to undertake these Inventions, after the many failings  
of

of others, well knowing that withing Ten miles of *Dudley* Castle there to be neer 20000. Smiths of all sorts, and many Iron works at that time, within that Circle decayed for want of Wood (yet formerly a mighty Woodland Country.)

Secondly, The Lord *Dudley's* Woods and Works decayed, but Pitcoal and Iron, Stone or Mines abounding, upon his Lands, but of little Use.

Thirdly, Because most of the Coale Mines in these parts, as well as upon the Lord *Dudley's* lands, are Coals, Ten, Eleven, and Twelve yards thick; the top or the uppermost Cole, or vein, gotten upon the superficies of this Globe or Earth, in open works.

Fourthly, Under this great thickness of Coal, is very many sorts of Iron, Stone, Mines, in the Earth Clay or Stone earth, like bats in all four yards thick; also under these Iron mines is severall yards thick of Coals, but of these in an other place more convenient.

Fifthly, Knowing that when the Colliers are forced to sinck Pits for getting of ten yards thick of Cole one third Part of the Coles or more, that be gotten under the ground, being small are of little or of no use in that inland Country nor is it worth the drawing out of the Pits, unlesse it might be made  
use

use of by making of Iron therewith into cast works or Bars.

Sixthly, Then knowing that if there could be any use made of the smal-coale that are of little Use, then would they be drawn out of the Pits, which coles produceth often times great prejudice unto the Owners of the works and the work it self, and also unto the Colliers, who casting of the smalcoles together, which compelling necessity enforcing the Colliers so to do, for two causes; one is to raise them to cut down the ten yards thicknesse of coles drawing onely the bigger sort of cole, not regarding the lesser or small cole, which will bring no money; saying, *He that liveth longest let him fetch fire further*: Next, These Colliers must cast these coles, and sleck or drosse out of their wayes, which sulphurious small cole and crouded moyst sleck heat naturally, and kindles in the middle of those great heaps; often fals the cole-works on Fire, and flaming out of the Pits, and continue burning like *Ætna* in Cicily, or *Hecla* in the Indies.

Yet when these loose Sulphurious compost of cole and sleck, being consumed in processe of time, the Fire decays, yet notwithstanding the Fire hath continued in some Pits many years; yet colliers have gotten coles again, in those same Pits, the Fire not  
penetrating

ping, which Iron being so tryed by Artists and Smiths, that the iron masters and Iron-mongers were all silenced until 21th of King Iames: At the then Parliament, all Monopolies were made Null, and diverse of the Iron-masters endeavouring to bring the invention of making Iron with Pitcole, Seacole, Peat and Turff, within the compasse of a Monopoly; but the Lord Dudley and the Authour did prevaile; yet the Pattent was limited to continue but Fourteen years; after which Act the Authour went on with his invention cheerfully, and made annually great store of Iron, good and merchantable, and sold it unto diverse men yet living at Twelve pounds per Tun; I also made all sorts of cast iron Wares, as Brewing-Cysterns, Pots, Morters, and better and cheaper than any yet were made in these Nations, with Charcoles; Some of which are extant to be seen by any man (at the Authours House in the City of Worcester) that desire to be satisfied of the truth in the Invention.

Afterwards, The Author was outed of his works and inventions before mentioned by the Iron-masters and others wrongfully, over long to relate: yet being unwilling his Inventions (having undergone much charge and pains therein) should fall to the ground, and be buried in him, made him to set forward his Invention again, at a Furnace called, Himley Furnace  
in



in the County of Stafford, where he made much Iron with Pit-cole, but wanting a Forge to make it into bars, was constrained for want of Stock to sell the Pig-Iron unto the Charcole Iron-masters, who did him much prejudice, not onely in detaining his stock, but also disparaging the Iron: Himley Furnace being Rented out unto Charcole Iron-Masters.

The Authour Erected a new large Furnace on purpose, 27 foot square, all of stone for his new Invention, at a place called, Hasco Bridge, in the parish of Sedgley, and County of Stafford; the Bellows of which Furnace were larger then ordinary Bellows are, in which work he made 7 Tuns of Iron per week, the greatest quantity of Pit-cole-Iron that ever yet was made in Great Brittain; near which Furnace, the Author discovered many new Cole-mines 10 yards thick, and Iron-Mine under it, according to other Cole-works; which Cole-works being brought unto perfection, the Author was by force thrown out of them, and the Bellows of his new Furnace and Invention, by riotous persons cut in pieces, to his no small prejudice, and loss of his Invention of making of Iron with Pit-cole, Sea-cole, &c. So that being with Law-Suites, and Riots, wearied and disabled to prosecute his Art and Invention at present, even untill the first Pattent was extinct: Notwithstanding the Au-

thor his sad Sufferings, Imprisonments wrongfully for several thousand pound in the Counter in London, yet did obtaine a new Pattent, dated the 2d of May, Anno 14. Caroli Primi of ever Blessed Memory, not only for the making of Iron into cast-works, and bars, but also for the Melting, Extracting, Refining and Reducing of all Mines, Minerals and Mettals, with Pit-cole, Sea-cole, Peat, and Turf, for the Preservation of Wood and Timber of this Island; into which Pattent, the Author, for the better support and management of his Invention, so much opposed formerly at the Court, at the Parliament, and at the Law, took in David Ramsey, Esquire, Resident at the Court; Sir George Horsey, at the Parliament; Roger Foulke, Esquire, a Counsellour of the Temple, and an Ingenious Man; and also an Iron Master, my Neighbour, and one who did well know my former Sufferings, and what I had done in the Invention of making of Iron with Pit-cole, &c.

All which said Patentees, Articled the 11th of Iune following, the Grant not only to pay the Authour all the charges of passing the Pattent laid down by him, but also to lay in for a common and joynt-stock each man of the four, one hundred pounds, and so from time to time, what more stock any three of the Patentees should think fit to be laid in for the making  
of

of Iron into cast works and bars, and likewise for the Melting, Extracting, Refining and Reducing of all Mines, Minerals, and Metals, with Pit-cole, Sea-cole, Peat and Turf, which Articles are yet extant.

Now let me without offence insert the opposition we all had, by means of powerfull Iron-Masters, with Sir Philibeard Vernat, a Dutch Man, and Captain Whitmore, who pretended much unto his late Sacred Majesty, but performed not their undertaking, which caused the Author, and his Partners thus to Petition.

*To the King's Most Excellent Majesty.*

The Humble Petition of Sir George Horsey Knight ;  
David Ramsey, Roger Foulke, and Dud Dudley,  
Esquires :

Humbly Sheweth,

That whereas Your Petitioners being called before the Right Honourable, the Lord Keeper by Your Majesties Appointment, touching the making of Iron with Pit-cole, Sea-cole, Peat and Turf, for which they  
have

have Your Majesties Pattent; and seeing that Sir Philibeard Vernat, and Captain Whitmore, who are not Inventors, have obtained a Pattent also for the same; yet before their Pattent Granted, Sir Philibeard was ordered at Council-board, according to his Great Undertaking, to perfect his Great Undertaking and Invention within Two Years, and there hath been near Three Years passed, and yet have made little or no Iron: still he Opposeth Your Petitioners, and doth neither benefit himself, but hinders Your Majesty, and the Kingdom.

The reference unto the Petition followeth; At the Court at Greenwich, May 20, 1638. His Majesty is pleased to refer this Petition to Master Attorney, and Master Solicitor General, to call the Petitioners before them, and to compose the differences between them; (if they can) or otherwise, to certifie his Majesty their opinions therein:

Sir Sidney Mountegue was then

Master of the Requests.

But Sir Philibeard Vernat, and Captain Whitmore never appeared any more for their Invention.

Not long after the Wars came on, and caused my  
partners

partners to desist, since which they are all dead, but the Author, and his Estate (for his Loyalty unto his late Sacred Majesty) and Master, (as by the Additional Act of Parliament may appear) was totally sold.

Yet nevertheless, I still endeavoured not to bury my Tallent, took in two Partners into my inventions, Walter Stevens of Bristow Linnen Draper, and John Ston of the same City Merchant, after the Authour had begun to Erect a new work for the Inventions aforesaid, near Bristow, Anno 51, and there we three Partners had in stock near 700l. but they not only cunningly drew me into Bond, entered upon my Stock and Work, unto this day detained it, but also did unjustly enter Staple Actions in Bristow of great value against me, because I was of the Kings Party; unto the great prejudice of my Inventions and Proceedings, my Pattent being then almost extinct: for which, and my Stock, am I forced to Sue them in Chancery.

In the interim of my proceedings, Cromwell, and the then Parliament, granted a Pattent, and an Act of Parliament unto Captain Buck of Hampton Road, for the making of Iron with Pit-cole and Sea-cole; Cromwell, and many of his Officers were Partners, as Major Wildman and others; many Doctors of Physick,

sick, and Merchants, who set up diverse and sundry Works, and Furnaces at a vast charge, in the Forrest of Dean, and after they had spent much in their Invention and Experiments, which was done in spacious Wind-Furnaces, and also in Potts of Glass-house Clay; and failing afterwards, got unto them an Ingenious Glass-Maker, Master Edward Dagney an Italian then living in Bristow, who after he had made many Potts, for that purpose went with them into the Forrest of Dean, and built for the said Captain Buck and his Partners, a new Furnace, and made therein many and sundry Experiments and Tryals for the making of Iron with Pit-cole and Sea-cole, &c. But he failing, and his Potts being all broken, he did return to Bristow frustrate of his Expectation; but further promising to come again, and make more Experiments; at which time Master John Williams, Master Dagneys, Master of the Glass-House was then drawn in to be a Partner for 300l. deposited, and most of it spent, the said Williams and Dagney hearing that the Authour had knowledge in the making of Iron with Pit-cole, Sea-cole, &c. they from Cap. Buck, and the other Partners importuned the Author, who was at that time in great danger by the Parliament, (being a Colonel of the Kings Party) to go along with them into the Forrest of Dean, which at that time durst not

not deny; Coming thither, I observed their manner of working, and found it impossible, that the said Edward Dagney by his Invention should make any Iron with Pit-cole or Sea-cole, in Pots to profit: I continued with them till all their Potts and Inventions failed; at every Dinner and Supper, Captain Buck, Captain Robins, Doctor Ivie, Doctor Fowler and others, would aske the Author why he was so confident that Iron in quantity could not be made by their new Inventions? I found it a difficult thing to dissuade the Partners from their way, so confident were they to perform the making of iron with Pit-cole or Sea-cole to profit; that they desired me to come again a second time into the Forrest to see it Effected; But at that time, I saw their failings also.

Yet nevertheless Captain Buck, and his Partners Erected new Works at the City of Bristow, in which they did fail as much as in their former Inventions; but Major Wildman, more barbarous to me then a Wildman, (although a Minister bought the Authors Estate, near 200l. per Annum, intending to compell from the Author his Inventions of making of Iron with Pit-cole; but afterwards passed my Estate unto two Barbarous Brokers of London, that pulled down the Authors two Mantion Houses; sold 500 Timber Trees off his Land, and to this day are his Houses unrepaired.

Anno

Anno 1655. Captain Buck and his Partners wearied of their Invention, desisting, An. 1656. Captain John Copley from Cromwell obtained another Patent for the making of Iron with Pit-cole and Sea-cole; He and his Partners set up their Works, at the Cole-Works near Bristow, and endeavour'd by Engineers assistance to get his Bellows to be blown, at, or near the Pits of Cole, with which Engines the Work could not be performed: But the Author coming to see the said Works, and after many Discourses with Captain Copley, his former Acquaintance, told him plainly, if his Bellows could have been blown by those Engines, yet I feared he could not make Iron with Pit-cole or Sea-cole; he seemed discontented; whereupon, and without those Engines I made his Bellows to be blown feisibly, as by the Note under his hand appears (the first Note) followeth;

1656. December 30.

Memorandum, The day and year above-written, I John Copley of London, Gent. Do acknowledge, that after the Expençe of diverse Hundred Pounds to Engineers, for the making of my Bellows to blow, for the making of Iron with Pit-cole or Sea-cole near Bristow, and near the Forrest of Kings-wood; that Dud Dudley, Esq. did perform the blowing of the  
said



said Bellows at the Works or Pits abovesaid; a very feisible and plausible way, that one man may blow them with pleasure the space of an hour or two; and this I do acknowledge to be performed with a very small charge, and without any money paid to him for the same Invention:

John Copley.

Captain John Copley thus failing in his Inventions, An. 1657, he went into Ireland, and all men now desisting from the Inventions of making of Iron with Pit-cole and Sea-cole: The Author, Anno 1660. being 61. years of Age, and moved with pitty, and seeing no man able to perform the Mastery of making of Iron with Pit-cole or Sea-cole, immediately upon his Sacred Majesties happy Restauration, the same day he Landed, Petitioned that he might be restored to his place, and his Pattent obstructed, revived for the making of Iron with Pit-cole, Sea-cole, Peat and Turf, into cast Works and Bars, and for the Melting, Extracting, Refining and Reducing of all Mines, Mettals and Minerals, with Pit-cole, Sea-cole, Peat and Turf; which said Laudable Invention, the Author was and is unwilling should fall to the ground and dye with him, neither is the Mistery, or Mastery of the Invention Effectuated and Perfected by any man known unto

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the

the Authour, as yet, either in England, Scotland or Wales; all which three abound with Pit-cole or Sea-cole, and do overmuch furnish other Kingdomes many with Pit-cole and Sea-cole, when they might make far better use of it themselves, especially Scotland and Wales, both for the making of Iron into cast Works and Bars; and also for the making of Steel, and Melting, Extracting, and Refining of Lead, Tin, Iron, Gold, Copper, Quicksilver, and Silver, with Pit-cole, and Sea-cole.

I shall not trouble you with the Petition, or my reasons and desires that were annexed unto it, for the making of Iron, and Melting of Mines, &c. with Pit-cole, &c. they are over long to relate, only the Reference to them is thus; (after my first Petition was lost, I Petitioned again.)

At the Court at Whiteh. 22. of June 1663.

His Majesty is graciously pleased to refer the consideration of this Petition to Master Attorney, and Solicitor General, or to either of them, together with the Petitioners Reasons and Desires hereunto annexed; and they, or either of them, are to inform, and certifie His Majesty, what they, or either of them in their Judgements respectively conceive fit for His Majesty to do concerning the Petitioners Humble Request,

quest, and then His Majesty will declare his further pleasure.

Robert Mason, Ma-  
ster of Requests.

After Master Attorney, and Sollicitor General would do nothing upon the Reference; the Author Petitioned His Sacred Majesty sitting at the Council-Board, for the Renewing of his Pattent, for making of Iron, and Melting, of Mines with Pit-cole, Sea-cole, often obstructed; the reference to that Petition followeth.

At the Court at Whitehall, July 25. 1660.

Upon reading of a Petition this day at the Board, being the same in terminis with this above-written, which His Majesty was graciously pleased by a Reference under the hand of Doctor Mason, one of the Masters of the Requests, to refer to the consideration of Master Attorney, and Master Solicitor General, together with the Petitioners Reasons and Desires thereunto annexed, to the Consideration of the Lords, and others Commissioners for the Treasury, who upon Examination of the particulars, are to give such order thereupon, as they shall find most proper for His Majesties Service.

Sir Edward Walker was  
Clark to the Council, and  
Garter King at Armes.

The Author, during the Lords Commissioners their time, could get no Order upon his Reference ; But his Petition was left, with the now Right Honourable, the Lord Treasurer, to take or grant further order therein, but the Author hath gotten hitherto no order.

Therefore compelling necessity doth constrain (having prosecuted his Petition hitherto) him to desist from his Inventions, in which he hath taken more pains, care and charge, then any man, to perfect his new Invention in these Kingdomes.

Although the Author hath not as yet so fully perfected or raised his invention, to the quantity of Charcole Iron Furnaces, yet the Authors quantity being but seven Tuns per week at the most, together with the quality of his Iron made with Pit-cole and Sea-cole, hath the most eminent Triplicity of Iron of all that can be desired in any new Invention.

1. More Sufficient. 2. More Cheap. 3. More Excellent.

Upon which triplicity, the Authour might enlarge himself, but shall not be tedious, only give me leave to mention that there be three sorts of Cast Iron ;

1. The first sort is Gray Iron.

2. The second sort is called Motley Iron, of which one part of the Soves or Piggs is gray, the other part is white intermixt.

3. The

3. The third sort is called white Iron, this is almost as white as Bell-Mettle, but in the Furnace is least fined, and the most Terrestrial; of the three, the Motley Iron is somewhat more fined, but the Gray Iron, is most fined, and more sufficient to make Bar-Iron with, and tough Iron to make Ordnance, or any Cast Vessels, being it is more fined in the Furnace, and more malliable and tough, then the other two sorts before mentioned; and of this sort, is the Iron made with Pit-cole, Sea-cole for the most part, and therefore more sufficiently to be preferred.

2. More cheaper Iron there cannot be made, for the Author did sell pigg or cast Iron made with Pit-cole at four pounds per Tun, many Tuns in the twentieth year of King James, with good profit; of late, Charcole Pig-iron hath been sold at six pounds per Tun, yea at seven pounds per Tun hath much been sold.

Also the Author did sell Bar-iron Good and Merchantable, at twelve pounds per Tun, and under, but since Bar-iron hath been sold for the most part ever since at 15*l.* 16*l.* 17*l.* and 18*l.* per Tun, by Charcole Iron-Masters.

3. More Excellent for diverse Reasons, and principally, being the 'meanes whereby the Wood and Timber of this Island almost exhausted, may be timely preserved

preserved yet, and vegetate and grow again unto his former wonted cheapness, for the maintenance of Navigation, which is the greatest Strength of Great Brittain, whose Defence and Offence for all the Territories that belong unto it, next under God and his Vice-Gerent, our Sacred Majesties Cares, consists most of Shiping, Men of War, Experienced Mariners, Ordnances, Ammunition, and Stores, the Ordnance made therewith will be more gray and tough, therefore more serviceable at Sea and Land, and the Bar-iron will wall, rivet, and hold better then most commonly Charcole Iron.

2. More Excellent, not onely in respect the Invention of making of Iron with Pit-cole and Sea-cole will preserve Wood and Timber of Great Brittain so greatly consumed by Iron-Works of late.

But also in respect, this my Invention will preserve many Millions of Tuns of Small-cole in Great Brittain, which will be lost in time to come, as formerly they were, for within ten miles of Dudley Castle, is annually consumed four or five thousand Tuns at least of small Pit-cole, and have been so consumed time out of mind under ground, fit to have it made Pit-iron with ; which coles are and (unless Iron be made therewith) will be for ever totally and annually lost ; if four or five thousand Tun of Cole be consumed within ten miles  
compass,

compass, what Coles is thus consumed in all England, Scotland, and Wales ! which is no good Husbandry for Great Brittain, hinc ille lacrimæ, that our Timber is exhausted.

Must I be still opposed, and never enjoy my Inventions, nor Great Brittain the Benefit ?

Must my Pattent be obstructed in Peace, as it was extinct by the Wars ?

And must not my Pattent be Revived for the making of Iron with Pit-cole, Sea-cole, Peat, and Turf, but find Enemies still to oppose it ?

How many thousand Tuns of Iron might have been made but since my first Invention, An. Jacob. 18th by my means with Pit-cole, and Sea-cole (lost) if I had not had Enemies ; and had not wood and timber been preserved ?

But most men will aver, that it doth concern the Author to Demonstrate the great losse mentioned formerly of Pit-cole annually ;

*It is thus,*

There is at least within ten miles of the Castle of Dudley, twelve or fourteen Cole-Works, some in Worcester, and some of them in Staffordshire (now in work, and twice as many in that Circute not in work) each of which Works get two thousand Tun of Cole yearly, some get three, four or five thousand Tun of Coles

Coles yearly : and the uppermost or top measures of Coles are ten, eleven, and some twelve yards thick ; the Coles Ascending, Basseting, or as the Colliers term it, Cropping up even unto the superficies of the Earth, and there the Colliers formerly got the Coles ; but where the Coles is deep and but little Earth upon the measures of Coles, there the Colliers rid off the Earth, and dig the Coles under their feet ; these Works are called Foot-rids.

But of these Works there are now but few, some of these small Coles in these open Works, the poor people did carry away, but paid nothing for them in former times, termed the Brain Carriages.

But now the Colliers working more in the deep of these Works, they are constrained to sink Pits some of which Pits are from eight unto twenty yards deep, and some are near twenty fathome deep, which fathome contains two yards.

In these Pits, after you have made or hit the uppermost measures of Cole, and sink or digged thorow them, the Colliers getting the nethermost part of the Coles first, about two yards in height or more, and when they have wrought the Crutes or Staules, (as some Colliers call them) as broad and as far in under the ground, as they think fit, they throw the small Coles (fit to make Iron) out of their way on heaps to  
raise



raise them up so high, to stand upon, that they may, with the working of their Picks or Maundrills over their heads, and at the one end of the Coles so far in as their Tool will permit, and so high as their working cometh unto a parting in the measure of Cole, the which Coles, to the parting by his self clogging and pondrous weight, fall often many Tuns of coles, many yards high down at once; with which fall and the Colliers breaking of the said Cole, many small coles do so abound of no use, and fit for no sale; that in getting of twenty thousand Tun of Pit-cole, one half near is small cole, not drawn out of the Pits, but destroyed, left, and lost; which small cole, with the sleek thrown moyst together, (heat the sooner) and by means of its sulphurousness fire in the Pits, to no small prejudice unto the Owners of the Works, and the Workmen, besides Great Brittain's Loss; which Cole might have made many thousand Tuns of Iron, and also have preserved this Islands Woods and Timber: I might here give you the names, and partly the nature of every measure, or parting of each cole lying upon each other; the three uppermost measures are called the white measures for his white Arcenical, Salsuginos and Sulphurous substance which is in that Cole; the next measure, is the shoulder-cole, the toe-cole, the foot-cole, the yard-cole, the sliper-cole, the sawyer-cole, and

the frisly-cole, these last three coles are the best for the making of Iron, yet other coles may be made use of.

I might give you other names of coles, but desire not prolixity, yet must I tell you of a supernumerary number of Smiths within ten miles of these Cole-Works near twenty thousand ; yet God of his Infinite goodness (if we will but take notice of his goodness unto this Nation) hath made this Country a very Granary for the supplying these Men with Iron, Cole, and Lime made with cole, which hath much supplied these men with Corn also of late, and from these men, a great part not only of this Island, but also of his Majesties other Kingdomes and Territories with Iron wares have their supply, and wood in these parts almost exhausted, although it were of late a mighty wood-land Country.

Now if the Coles and Iron-stone so abounding were made right use of, we need not want Iron as we do ; for very many measures of iron-stone are placed together under the great ten yards thickness of cole, and upon another thickness of coles two yards thick, not yet mentioned, called the bottom-cole, or the heathen cole, as if God had decreed the time when, and how these Smiths should be supplied, and this Island also with Iron, and most especially, that this cole and iron-stone, should give the first, and just occasion for the  
invention

invention of the making of iron with pit-cole, no place being so fit for the invention to be perfected in, then this Country, for the general good; whose Woods did formerly abound in Forrests, Chases, Parks and Woods, but exhausted in these parts.

Now for the names of the iron-stone, the first measure is called the Black-row-graines, lying in very hard and black Earth.

The second measure is the Dun-row-graines, lying in dun earth or clay.

The third measure is called the white row grains, lying in very white Earth or Clay; under these three measure are sundry other measures, and are called, first, the Rider Stone; secondly, the Cloud Stone; thirdly, the bottom Stone; fourthly, the Cannock or Cannotstone, which last may wel be so caled (although all the other measures be very good) yet this Stone is so Sulphurious and Terrestrial, not fit to make Iron; because the Iron thereof made is very Redshare, which is that if a workman should Draw or Forge out a Share mould fit for a Plough in that red heat, it would crack and not be fit for the Use of the Husbandmans Plough or Share. I may take occasion here to speak of the Nature of Coldshare Iron, which is so brittle if made of the grain Oare or Iron stone would be almost as brittle as some Regulus Antimonii

timonii made Iron, for with one small blow over an Anvil you may break the biggest Bar that is, if it be perfect coldshare Iron; nay the Plough-man often breaks his Share point off if it be made of coldshare Iron. But perfect tough malliable Iron will not break feisibly in hot-heat or cold, as coldshare wil, or red hot as Sulphurious veneriated redshare Iron will; but yet tough enough when it is cold: All which afore-said qualities of Iron the Authour very well knoweth how to mend their Natures, by finning or setting the finery, lesse transhaw more borrow which are terms of art, and by altering and pitching the works, and plates, the fore spirit-plat, the tuiron, bottome, back and breast or fore-plate, by the altering of which much may be done, if the work be set transhaw and transiring from the blast, the Iron is more coldshare lesse Fined, more to the Masters profit; lesse profitable to him that makes it into manufactorage, and lesse profitable to him that useth it; but the Iron made in a Burrow work, becometh more tough and serviceable; yet the nature of all Iron stone, is to be considered, both in the Furnace, and in the finery, that the Sulphurious Arceniall and Veneriating qualities, which are oftentimes in Iron stone be made to separate, in both the works from the fixed and fixing bodies of Iron, whose fiery quality is such, that he  
will

will sooner self calfine than separate from any Sulphurous veneriated quality.

No man, I hope, need to be offended at any terms of Art, it hath been alwayes lawfull for Authours of new Arts and Inventions, at their own pleasures, to give name to their new Inventions and Arts, every Tradesman is allowed it in his mystery.

But the Authour hath as much as he could avoided the terms of Art that Simon Sturtenante and others have used, which are very many: onely the Author hath given you the common names and terms (for the most part) which are so common among Forge-men and Founders, as is nothing more common; but kept secret amongst them and a mystery not yet known, but unto very few Owners of Iron-works; nay I have not yet troubled your memory with any of the Founder terms, of but making his harth as the Timpe stones, the Wind-wall stones, the Furion stones, the Botton-stone, the Back-stones and the Boshes, in the making and pitching of which harth, is much of the Mystery.

I must confesse, there is given unto some Phylosophers, etc filii Artis, some few terms how the Sulphurous Arsenicall, Bituminos, Antimoniall, Venerial, and other poysonous qualities, either in the Pit-cole, Sea-cole, or the Iron-stone, may be in part at the Furnace separated,

separated, and not be permitted to incorporate in the Iron, and if it be incorporated, yet by Fining at the Forge, to fetch it out; also to melt extract, refine, and reduce all mines mettals and minerals, unto their species with Pit-cole, Sea-cole, Peat, and Turff, by wayes not yet in use, which the Authour will make known, hereafter, if God permit him health, time and space, or leave his knowledg unto his Brother Aylmore Folliott, Esq; his Nephew Parks-house, Esq; and to his Kinsman Master Francis Dingley, to declare unto this latter Age of the World, in which God is pleased to manifest many of his Secrets; *Qui vult secreta scire, secreta secreta sciat custodire.*

Having suffered much, ever since the Year 1618. unto this present, for the general good, as by the preceding discourse appears for the making of Iron with Pitcole, Seacole, Peat, and Turff; for the preservation of Wood & Timber of Great Brittain so much exhausted, for future prevention of which,

Is first, to permit the Authour to enjoy His Patent, and fully to perfect his said Inventions (obstructed in the Reign both of King James and in the Reign of his Sacred Majesty King Charls the First, of ever Blessed Memory; and lately since his most Sacred Majesties happy Restauration) who desires nothing but to be animated with the Patent revived  
according

according unto the Statute of 21. Iacob. for Inventors.

Secondly, to impower the Authour or any other Agents to take care that no Pit-cole, or Seacole be any wayes wilfully destroyed under ground.

Thirdly, To put all former good Laws in Execution, and to make others for the preservation of Wood and Timber of these Nations, especially neer Navigagable River or Seas.

Fourthly, Seeing there goeth out of England, Scotland and Wales, many thousand Tuns Annually of Pitcole and Seacoles to furnish France, and also the Smiths thereof Spaine, Portugal and Flanders, and especially the Smiths thereof; the Low-Countries and the Smiths thereof, besides the Hollanders carries great quanties of our Coles unto Foreigne parts, without which those Countries cannot subsist: Now the Authors desire is, that where there is a conveniency of Iron stone or Ewre, the Coles may not be transported (paying His Sacred Majesties Duty) untill Order from His Majesty or his Privy Council.

Fifthly, That no Pitcole be Exported, seeing that Wood fuell and Timber is decayed for Buildings, and instead thereof Brickmaking (formerly spending Wood, but now coles) is much in use; also is Glasse now made with cole, but formerly were there many Thousand  
Loads

Loads of Wood fuell spent in the making thereof, and the Glass Invention with Pitcole was first effected near the Authours Dwelling.

Sixthly, Making of Steel, Brewings, making of Coppras, Allum, Salt, casting of Brasse and Copper, Dyings, and many other Works were not many years since done altogether with the Fuell of Wood and Charcole; instead whereof, Pitcole, and Seacole is now used as Effectually, and to a far better Use and Purpose; besides the preservation of Wood and Timber.

Seventhly, That which is somewhat neerer the mark and Invention; the Blacksmith forged all his Iron with Charcole, and in some places where they are cheap, they continue this course still, but small Pitcole and Seacole, and also Peat and Turff hath and doth serve the turn as well and sufficiently as Charcole.

Eighthly, That which is nearest, and my perfect Invention, and neer the Authours Dwelling, called Greens-lodge, there are four Forges, namely, Greens-forge, Swin-forge, Heath-forge and Cradley-forge.

Which Four Forges have Barred all or most part of their Iron with Pitcole ever since the Authours first Invention, 1618. which hath preserved much Wood: In these Four, besides many other Forges do the like; yet the Author hath had no benefit thereby to this present.

Yet



Yet by this Barring of Iron with Pit-cole 30000 loads of Wood and more have been preserved for the general good, which otherwayes must have been had and consumed.

Symon Sturtevant, in his *Metallica*, in the Epistle to the Reader, saith, That there was then Anno 12. Jacobi in England, Scotland, Ireland and Wales 800 Furnaces Forges, or Iron Mills making Iron with Charcole: Now we may suppose at least 300 of these to be Furnaces, and 500 to be Forges; and each Furnace making fifteen Tun per week of Pig or cast Iron, and work or blow but Forty week per Annum, but some Furnaces make Twenty Tuns of Pig Iron per Week, and two Loads of Charcole or there about, go to the making of a Tun of Pig Iron: And two Loads (or two cords) of Wood at the least, go to the making of a Load of Charcole.

Now what Loads of Wood or Charcole is spent in great Brittain and Ireland Annually? but in one Furnace, that makes Fifteen Tun per Week of Pig-Iron for Forty weeks: I shall give you the Table, and leave you to judge of the rest of the Furnaces.

15. Tun per week spends of		Charcole,	Wood,
		30 loads	60 loads.
Per Annum 40 weeks spends		1200	2400 loads.

G

Also

**3 Tun per week Charcole                      Wood**

By these Examples, may you see, the vast quantities of Charcole, or Wood, that the 300 Furnacis spend weekly, or yearly, and the 500. Forges workings all the year, spend little lesse then the Furnaces: It being impossible, after this rate for Great Brittain or Ireland, to supply these her works with Charcole in Fining of Iron at the Fineries, yet the Forges that need but half the Charcole may be permitted to use Charcole, and may be supplied with under Woods.

Let us but look back unto the making of Iron, by our Ancestors, in foot blasts, or bloomenies, that was by men treading of the Bellows, by which way they could make but one little lump or bloom of Iron in a day, not 100 weight, and that not fusible, nor fined, or malliable, until it were long burned and wrought under Hammers, and whose first slag, sinder or scorius, doth contain in it as much, or more Iron, then in that day the workman or bloomer got out, which Slag,

Slag, Scorijs, or Sinder is by our Founders at Furnaces wrought again, and found to contain much Yron and easier of Fusion than any Yron stone or Mine of Yron whatsoever of which slag and Sinders, there is in many Countryes Millions of Tuns and Oaks growing upon them, very old and rotten.

The next invention was to set up the Bloomeries that went by water, for the ease of the men treading the bellows, which being bigger, and the waterwheel causing a greater blast, did not onely make a greater quantity of iron, but also extracted more iron out of the slag or sinder, and left them more poorer of iron then the foot-blasts, so that the Founders cannot melt them again, as they do the foot blast sinders to profit: Yet these Bloomeries by water (not altogether out of use) do make in one day but two hundred pound weight of iron, or thereabouts neither is it fusible, or malliable, but is unfined untill it be much burned, and wrought a second time in fire.

But some of the now going Furnaces with Charcole, do make two or three Tun of Pigg or cast iron in 24 hours.

Therefore I do not wholly compute the vast quantities of charcoles and wood spent in these voragious works, which quantity of cast iron, with pit-cole and Sea-cole, at one Furnace I desire not, but am contented

tented with half the proportion, which once I attained unto before my Bellows were riotously cut, that is one Tun in 24 hours; we need not a greater quantity, if the like quantity were made in Furnaces in Scotland, and Wales, which abounds with Pit-cole and Sea-cole, as well as England; and our supernumery Smiths, Founders, and Forgemen, and other Tradesmen might be there imployed, thereby to furnish His Majesties Plantations, as well, if not better then England, where Coles are far cheaper then in England.

Although vast quantities of Coles do abound near the Authors dwelling, yet twenty thousand Smiths or Naylors at the least dwelling near these parts, and taking of Prentices, have made their Trade so bad, that many of them are ready to starve and steal; so that it is wished there were some courses taken to mend their Trade, imploy them in other parts, or permit them, not to take so many Prentices, all which have great occasions to use Pit-cole, and had not these parts abounded with cole, it would have been a great deal worse with them then it is; but of the cole there is, nor will be any want, nor of iron-stone.

The manner of the cole-veins, or measures in these parts, and also of the measures of iron-stone, or mines, how they lye, be, or increase, some veins lye  
circuler,

[40]

circuler, some sami-circuler, some ovall, some works almost in a direct line, and some works parts of a Circle; as by the Circle, it being onely for a small Example to judge the rest of the Mines by may appear.

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*F I N I S.*

---

ΛΛ East.  
 Λ West.  
 ΛΛΛ North.

Time not permitting me to give you a Larger  
Mapp, conclude, etc.

- A Two Gutters out of which issueth Water, as hot  
as that at Bath.
- B The way from Himley to Dudley, and from Dud-  
ley to Burmicham.
- C Dudley Castle.
- Coles ten yards thick.
- Iron-stone four yards thick.
- o Coles two yards thick.

The Scale for Cole, and Stone per yard.



By the white innermost Circle, you may conceive  
the Scale under to be over in Diameter, a mile and a  
half.













A

# Treatise of Metallica

But not that which was  
published by Mr. Simon Stvrtevant  
upon his Patent, which is now by order  
cancelled and made voyd, by reason of his  
standing out-lawed at the time of  
the grant, and so still continuing  
and his neglect, and not per-  
formance of the workes

Whereupon Priviledge By  
Patent, is granted by the King's most ex-  
cellent Magesty to John Rovenzon Esqr. for  
the making of iron, and other materials with  
Sea-cole, Pit-cole, &c. for one and thirty yeares,  
according to which Patent, and direction within,  
this Treatise, composed by the same John Rovinson,  
is published in Print before the end of  
Easter Tearme, viz. the

15th of May

1613

[2]

And containeth a briefe explanation,  
Demonstration, or Discouery of the  
Inuentions priuiledged, and the means  
Instruments, Engins, Furnaces & with  
the materials, things, and workes to be  
made by the said Fewels.

The charge of an Iron-worke with Sea-cole,  
is set downe in the latter end of this Booke.

London

Printed for Thomas Thorp

1613

Cum Priuilegio

## TO THE KINGS MOST Excellent Majesty.

Most dread Soueraigne,

**Y**our Majesty hauing been pleased to grant unto me Sole priuledge for one and thirty yeares by your gracious Letters Patent, to make and worke iron, other Mettals, and diuers other materials with Sea-Cole, and such other Fewels; wherewith it hath pleased God to blesse my poore intentions and Enduours, by effecting those workes which haue beene heretofore worthily attempted by others, though with fruitlesse succeſſe, I held it my duty upon publication of these inuentions, to present the same to your Royall View, humbly beseeching your Majesty to accept them as a neur-dying Memoriall of the late most Excellent Prince Henry your Sonne; whose desire of the publique good (besides many particular favours which he was pleased to vouchsafe unto me) was the first motiue and Author to encourage me to make triall, and to accomplish these works which I hope will proue so profitable to your Majesty, and so enriching to your Kingdomes, as you will neuer have cause to

[4]

repent your gracious favour and pruiledge herein bestowed on me.

The Lord of Heaven and Earthe blesse and preserue your Majesty, your most excellent Queene, and hopefull Royall Issue.

Your Majesties most humble  
and obedient Subject

***Iohn Rovenzon.***

## *To the Reader.*

**I**t is not my purpose to commend my inuentions of making and working Mettals and other Materials and things with Sea-cole, and such other fewels: What I haue performed herein, in that which hath been held most difficult, by making iron with Sea-cole, is sufficiently knowne, to the full satisfaction of some iudiciall Iron-masters Founders, and others experienced in Iron-workes therein done. Yet am I farre from arrogating all to my owne meere Inuention. For howsoeuer the maine workes, and the use of the priuiledged fewels thereabouts, with the Furnaces, haue beene deuised and acted by myselfe in the workes of most difficulty; yet many Instruments, operations, and meanes Metallicall, being necessarilly to be used for the better, more easie, and cheape working and effecting the workes, I do willingly acknowledge to the world, that the conferences and informations of many my good friends, who haue beene desirous to further these workes, and the priuiledge granted to his Majisty to me, haue added much to my own Inuentions, and giuen great light and furtherance, by meanes of diuers new-deuised operations, instruments, and Engines: Onely thus much more I thought good

to giue notice ; That whereas it pleased the late most excellent Prince deceased upon a grant of priuiledge obtained by his meanes for one Maister Sturtueant, for the like workes, to commit the trust of making and registering of all Indentures and Conueyances thereabouts, with acquittances upon all receipts of money, or other profites thereby to Maister Ferroure of Graies Lane Esquire, his Majesties seruant, to the end that euery aduenturer, and other that was to receiue benefite thereby might haue his due without deceit, or diminishment, which was also agreed unto, and confirmed to Maister Ferroure, by grant of Maister Sturtueant under his hand and Seale : which Patent is by reason of the neglect of performance by Maister Sturteuant, and by his standing out-lawed at the time of the Patent granted, and still continuing become forfeited, made voyd, and cancelled.

And the like priuiledged granted by his Majesty to me ; in regard whereof, and for that Maister Ferroure hath been my chiefe assistant, and aide to effect these workes, and an Eye-witnesse of all my endeouours therein. And besides I knowe and am priuy, that it was alwayes the purpose and intention of the late Prince, that upon my performance of these workes, and obtaining his Majesties grant of priuiledge thereupon, Maister Ferroure should make and register all Conueyances and Acquittances that should bee made,



by reason of my priuiledge, as he should haue done, if Maister Sturteuants had remained in force: I haue therefore authorized Maister Ferrou, accordingly to make and register the same, giuing hereby knowledge thereof to all whom it may concerne; and such as shall be willing, or desirous to aduenture, or deale in, or about any thing concerning ough contained within his Majesties Letters Patents to mee made and granted, that they may repaire to Maister Ferrou at his Chamber in Graies-Inne, or to such other place as he shall appoynt, wherein to write, make, and register the said Conueyances, and Acquittances, where they may know of him, in what sort, and upon what tearmes and conditions they shall be dealt with.

And because some Aduenturers with Mr. Stureuant, by his neglect and forfeiture, were in danger to sustaine losse, such hath beene his Maiesties Royall care of such as dis-bursed money, to, or with Maister Sturteuant, by, or upon meere aduenture, to forward the workes, that a speciall clause and prouiso is contained in the Identure of Priuiledge, to me made and granted, that I am to performe and undergo such order for their recompence and satisfaction, as shall be held fit in Equity by his Majesties Barons of his Highnesse Court of Exchequer. But if such Aduenturers shall be willing to make knowne the manner and truth of their Aduentures to me or Maister Ferrou, and to

heat with us thereabouts, I doubt not but such conclusion shall be made, as they shall not need to make any further complaint elsewhere for their reliefe. To print the whole patent is a worke both tedious and superfluous; only the Inducement of his Majesties grant, the tearme of yeares, the effect of the thinges priuiledged, and the distribution of the profites, is fit to be made knowne; to which end I haue caused an Abstract thereof to bee abridged out of the Indenture and committed to the Presse together with the Treatise of Metallica containing a brief of the meanes and manner of the workes intended. And so

I rest,

Your louing friend

***John Roventon.***

## **The Inducement**

to his Maiesties grant made  
to Iohn Rovenzon Esquire  
abstracted out of the Inden-  
ture of Priuiledge.

**U**pon affirmation by Simon Sturteuant, that hee could performe the workes, and had effected the same in small trials, the same Iohn Rovenzon made known the same to the late Prince his Highnesse, who there-upon, at the humble suit of the said Iohn Roven obtained Letters Patents of priuiledge to Maister Sturteuant for 31 yeares.

Maister Sturteuant oft promised to haue performed the workes long since in the said late Prince his owne view; yet neglected it to his Maiesties hinderance of profite that might in this space haue accrued, by endeours of others.

The late Prince encouraged the said Iohn Rovenzon to make triall if he could performe the workes; who after many chargeable trialls by himselfe and friends, satisfactorily effected the same. The said Prince having been graciously pleased to assure him

that upon such performance, Maister Sturteuants Patent should bee deliuered up, and made voyd; and thereupon like priuledge should be granted to the said Iohn Rovenson, according to the effect of his Inuentions.

Maister Sturtueant stood out-lawed at the time of the grant to him made, and so still continueth, which was found by office, and his patent seized, and apprized, and deliuered up to bee cancelled, which is done, his Patent made voyd, and priuledge granted to the said Iohn Rovenson for one and thirty yeares to work the workes &.

The effect of the Priuledge.

I. Sole priuledge to make Iron and all other Mettals, Ash-mettals, Bugles, Tiles, Potters-ware, Concrets of boyleryes, & with many other things, with Sea-cole, Pit-cole Earth-cole &. The perticulars of the things are most of them specified hereafter.

II. Sole priuledge for making all Instruments, Engines, and meanes &. onely for these workes; which Instruments &. are by this new Inuention conuerted to these workes, hauing beene heretofore used in other sciences, Arts, or Mysteries.

III. Sole priuledge for making all the new deuised furnaces, Fire-workes, instruments, Engines, Meanes, and inuentions, either for the workinge of the workes with the said fewels, or for any other end or purpose whatsoever.

These are granted in as absolute manner and forme as they are contained, or mentioned in the Indenture of Pruiledge, or the Schedules thereunto annexed, or shall be more fully demonstrated, specified or mentioned in the Treatise of Metallica, to be printed before the last day of Easter Tearme; which Treatise is this present Booke.

The distribution of the Profites.

The clearly yearely Profites are to be divided into 33 parts, whereof the said Iohn Rovenson is to pay twelue parts to the King's Maiesty; fiue parts to the now his Highnesse; one part to the Lord Viscount Rochester; one part to the said Iohn Rovenson is to keape himselfe; And the residue, being fourteene parts, are to be distributed by his discretion, and by such proportions as hee shall thinke fit, amongst the Aiders, Assisters, Aduenturers, and owners of the workes.

# **The Treatise Of Metallica.**

The meanes whereby the workes are to bee performed, containing a briefe of the new-diuised Instruments, Engines &.

**T**he Instruments, Engines, Deuises, and Meanes for performance of the workes, are either Preparatory before the Mettals, or Materials come to be wrought; or Preparatory after the Minerals, or fewell drawne; or else are used about the workes themselues.

Preparatory before the Mettals or Materials come to bee wrought, are the meanes of most easie and least chargeable getting, and acquiring the Ewers, Minerals, Mettals, Materials, or Fewell, which consisteth in speedy digging, in quicke sinking of pits, in speedy remouing of impediments that may hinder the digging or sinking of pits; in the easie drawing the ewers, minerals or works coles out of the pits; and in

the speedy and easie lading forth of the water therein, and draining the pits.

Preparatory, after the Minerals or Fewell drawne are the more easie and speedy carriage; and after that, the making, dry and nealing of the Furnaces, and preparing some of the Materials, by beating burning, or breaking; and others by tempering mount continually, and may be conuerted to haue passage through pipes, cockes or conduits for seruing of Houses, Townes, or Citties: others are new deuised milnes, to go by the labour of men, winde, water, horse, or diuers of them together, to raise Hammers or Bellows for mettallickal workes; or to grind or breake metallical ewers, and Minerals into powder; and may bee employed to drawing of mines, cole-pits, Fennes, marishes, or to such common uses of grinding, fulling tucking & that other common milnes are used for, and will doe as much with lesse charge, toyle and expense.

A new kind of artificiall cloth, deuised for sale-clothes, for the new-deuised winde-milnes, made either of linnen, or wollen, or both mixed together, by a new kinde of weauing which may be transferred to making of a very broad new kinde of Wollen cloth, neuer heretofore usually made or knowne in any of his Maiesties Dominions, and will serue for curtaines or hangings, mentioned in the Schedules, annexed to

the said Indenture of priuledge and may be so dyed in wool, and wouen by this new kinde of weauing, and dressed on both sides, that it shall bee of two seuerall colours : one colour (as greene, or any othe colour) on the one side ; and blew, or crimson, or any other colour, on the other-side ; the cloth being much finer then any now usually made, and sauing abundance of wool, by using lesse in weight, and thereby increasing the number of clothes ; and yet as durable, or more durable, then the now usual broad-clothes, and reasonable cheape to be bought, and are some of them to be made two-yards broad, so as a cloak may be made thereof without seame. The making hereof will set more people, (by many) on worke, then the clothing in common use.

There is a new deuised Engine, which will either with Augors, bore-holes, under the clampes of Sea-cole or Pit-cole, or any-othe Minerall ; or with a rapping-wheeke make such Rigals, that they may fall the easier, and with lesse charge, and toyle of men, and will serue for many other uses.

Certaine new-deuised Engines, for the pulling up of great roots of trees, or great stones, with one mans strength at once : which roots and stones may otherwise hinder the speedy digging and sinking of cole-pits, or mines.

A new deuised Engine, or Instrument for sawing of



timber for proppes, or otherwise in mines ; or for sawing Free-stones, or Fire-stones, or for Furnaces, which one man's labour will saw as much as sixe or eight men now usually saw, and may be converted to sawing of boords, or other things, or to raping of Logwood, Brasill, or other woods for Dying.

Certain new deuises, or engines to ease carts, and Waines in carriage of coles, or other minerals halfe in halfe ; and may be conuerted to coaches, carriches and other carriages ; so as two horses may draw as much as foure usually doe ; And by this deuice and engines, and with some other additions, three ploughs in light ground, and two ploughs in other ground may bee made to goe and worke with one man onely, and as few cattell as are now used for one plowe, ridding twice or thrice as much worke in one day.

A new deuise, engine or meanes for the easie rowing of Barges or Boats, for carriage of Coles, Mettals, or any other thing.

A deuice or engine, or meanes for the easier rowing drawing up such Barges or Boats through weeres or lockes for their speedier passage and carriage.

Certain new deuised Carriages, Carts, or Waines to bee made to goe, or trauell alone, by reason of certain motions, or serues to be used by one man ; and in some a horse may be set, onely to turn withall : and these carriages will carry thirty hundred weight at

once (an ordinary pace and an usuall dayes journey, and may bee conuerted to coaches, and other common carriages.

Diuers new deuised Engines, Instruments, and meanes for the rearing of Hammers or Bellows for Iron-milnes, or workes, or other metallical operations, and may bee conuerted to the dressing, rowing and fulling of cloath; and also to the sawing of timber; so as one man may perform as much as many. And some of these Engines will make both Bellows and Hammer to worke at once, and with one and the same Engine, and with one mans labour without winde or water.

A new-deuised Engine or Instrument to digge with, which with labour of two men shall performe as much as twenty men, and serueth chiefly for the speedy and easie getting of the fewels of peat, and turfe, and is of excellent use for the speedy cutting and scouring of riuers.

Diuers new-deuised meanes or engines, whereby a breach in any bank or stoppage, for conueueying of water out of cole-pits, or mines, the dambe or poole of any Iron-mill, or other mill, may be speedily, and easily stopped; and may be conuerted to stoppe any breach in the bankes of any riuers, or sea-bankes.

The Presse and mould and instruments deuised, or used for making of Presse-wares. Diuers new deuised

fire-workes, instruments, or Kilnes to put fire into, which are to be made of Iron, or other mettals, or materialls, with funnels, or passages to vent the smoake, are deuised to dry and neall furnaces, before full fire be put therein, and serue also to drye potter's-ware, before it bee burnt; and may bee of excellent use in ordinary kilnes to dry malt, starch, hops, saffron, or any such thing, with New-castle Sea-cole, or any other Sea-cole, or pit-cole; or with any turfe, peat, or flag; so as the malt, or other thing shall bee dried exceeding sweete, or faire, without sent, taint or touch of the fewell, or any smoak proceeding therefrom.

A new-deuised vetible, round and hollow, with a long spout to be made of some mettall or potter's earth wherein watter being put, and the same placed on a fire, as it heateh, and the water euaporateh by the spout, it maketh a continuall blast to kindle, or increase the fire in furnaces, or fire-workes, and may be conuerted to many other excellent uses; and the same may be so made in seuerall peeces with the top or upper part remoueable at pleasure, so as the lower part being made to stand on feet, may serrue at pleasure for a posset, skellet or boylatory; and when the top is put on, and when fastened and luted, it may then serue for the ventible to make the blast.

For such of the workes as require light to worke

by in the night, being distant from the places where the furnaces are, there is a new-devised luminary of glasse, or glasses filled with water & a candle placed to giue light through it, which giueth a very great light a great distance off, with small charge; and may be conuerted to excellent use, being placed in high-places in crosse-wayes, and streets of citties and townes, to the sauing of lanthorne and candle-light, and the auoyding of inconueniences happening by darknesse.

## **The Description of the Furnaces, and Fire-workes and Additaments.**

**F**urnaces are either such as are not of diuision wherein the mettall or materiall to be melted, or wrought lyeth together with the fewell in one place undiuided: or furnaces of diuision, wherein the mettall or materiall to be melted, or wrought is kept diuided from the fewell in seuerall places; so as no substance of the fewell, but onely the heat and flame thereof can touch the mettall or materiall.

The furnaces or fire-workes of diuision may bee made with bellows, or without bellows, as wind-furnaces which are best, and least chargeable.

These furnaces may bee made to haue the flame come up in the midst with a cisterne or hearth wherein the mettall lyeth on all sides encompassing the flame; or else the flame may come up betwixt two, or more cisternes or hearths; or else the flame may come up on one side of the hearth, or cisterne, or on both sides, or in seuerall angles, or places, without the hearths or cisternes, at pleasure of the owner.

The fewell always lying on grates without the cisterne or hearth, through which grates the aire, or winde gathereth, and so maketh the fire to burne, the ashes falling through the grate.

The furnaces or fire-workes may be made round, or long, or triangular, or quadrangular, or with more angles, or part circular or semi-circular, or part angular, or in as many seuerall parts or fashions as the owner pleaseth; and in euery of them the workes may be wrought, though in some better, or more readily than in others.

The furnaces may be made, with one, two, or three or more cisternes, or more hearthes, to containe the euers or mettalls to be melted, or wrought, so as, one, two, three or more sowes of Iron, or other mettall, may be made to run all at once, and euery of them of as great or greater weight as any sowes now ordinarily cast.

The furnaces may bee made either close on the top with some vent-holes, and so merely reuerbatory, the mettals, or materials to be melted, or wrought lying in the cisterne or hearth before it be melted, and is thereing melted, and thence run forth.

Or else the furnaces may be made with one, or more funnels, as it were chimneys on the top, or on the sides, or ends with grates of free-stone made in the bottos of those funnels, placed right ouer the

cisternes, or hearthes : in which funnels the materials to be melted, may be put, and the flame and fire shall haue only passage through those funnels, there melting the materials ; so as they fall melted thence into cisternes and hearthes, where they are cleansed, and thence run forth into sowes.

The furnaces may be made without wings, into which the flame may passe by vent-holes, or without such wings. These out-wings may serue to roast the Ewre, or for many other purposes.

The furnaces may be made with conuenient places therein for the finery and chaffery : so as one and the same furnace, with one and the same charge of fire, may serue both to melt, cleanse, and fine the mettals, and to do all the workes at once & in one place, that are now done in seuerall places, by finery, and chaffery ; and may be set up at the mine with an engine to raise the hammer &. with one man's labour there to be used without trouble of carriage, and without the charge of any water-milne.

The furnaces may bee made great and fixed for greater workes ; or small and moueable for smaller workes, and tryalls ; and by conueying, circling, or twining pipes of mettall, or burnt earth through any of them, through which pipes of water may haue passage, the one thereof being fastened on a cocke or conduit, and the other end kept stopt with a cocke, or

otherwise, or opened at pleasure. It may bee made to run hot water continually or so long as the party pleaseth to use; and then being remoued, the maine cocke or conduit may run cold water againe. All which may be performed with far lesse charge then is now used in heating of caldrons, kettles, or receiuers of water by felt-makers, launderers, or any others.

One and the same furnace may bee so contriued and made, as it may do all the workes of metallical of burning, melting, fining & the ewer or mettall; and also the worke of any boylery, to gather the concret thereof, or for any other purpose; and also to make a cocke or conduit run hot water; and also to make bugles, china-workes, and glasse-workes therein. And to bake and burne potter's-ware and other burnt earthes, or as many of those seuerall workes, as the owner pleaseth to be done at one and the same time, with one and the same fire.

All boylatories of things liquid, and all kilnes to dry malt, or other things & all clampes or kilnes to dry tiles or potter's-ware, or any thing of burnt earth (except only where New-castle Sea-cole is intermixt in burning of bricks) are fire-workes of diuision.

The said mettals of Iron &c. may bee also made with the same fewels in common bloomeries, fineries, and chafferries, but much better in bloomeries, fineries and chafferries of deuision which are of new inuention,



not yet usually used about the said workes, wherein the material to be melted or wrought may be kept, diuided, from touch of the fewels.

Certain new deuises in framing of chimneys and other things thereabouts, for drying of earthen-vessels, before they bee burnt, and for drying of concrets made by boyleries; which deuises may be transferred to common chimneys, whereby halfe the fewell, now used therein may be saued.

Certain new deuised vessels, or caldrons made of woode or mettall, or both, for boyling of liquors, or wort for brewers or others.

There are certain fluxes or additaments for the speedy and more perfect melting, seperating and purifying of Iron and other mettals from their slagge, drosse and cyndar; as transparent or glassy stones, or sand crisorall, or borax, gall of glasse, glasse beaten to powder; and for small tryalls of tin or lead, soap, or wax, or some fatty substance, are proper additraments; and lead itselfe is fit for seperating of other mettals: The slagge of former melted mettals, as the slagge of Iron to melt and purify Iron Ewre for which also Lyme and ashes of wood, and dust of char-coale, are used; and for small trialls, arsnicke, sulphur, vitriol, tartar, salt-gemme, salt-niter, and stybrum, some of which may also be used in greater workes, for which also salt-peter is by new

invention devised to be made cheape, and in one place continually without trouble of digging of houses, or stables, and may be converted to make gunpowder in abundance.

There is also some speciall new devised additaments, for the more speedy and perfect separating purifying of Iron, from the slagge, drosse, and cynder, in making of Iron with Sea-coale, or other the privileged Fewels; which special additaments are specified and prepared in writing, with the descriptions or models of diuers Engins, instruments, deuises, and inventions drawn in parchment, and remaining in custody of the fore-named Iohn Ferroure.

A new devised stone, for the opening and better dressing of Wooll, with a new kind of dressing and spinning thereof, for a new kind of cloathing.

## **The Materials and things to bee melted, made, or wrought by the Fewels of Sea-cole &.**

**A**ll Ewers, or Oares, and mettals of Iron, steele, brasse, copper, latten, tin, pewter, lead, Alchimy-ware bel-mettals, candlesticke-mettals, bugels, ammels, and all other things, whatsoever, simple, or commixt to be melted, made, or wrought to be conuerted into any stony, or glassy substance.

All burnt earths, or earthen vessels stone pots, earthen-pots, potters-ware tobacco-pipes, pipes of earth, cast-iron or other mettall, or stuffe whatsoever to conuey water in; pauing-stones mantle-trees for chimneys, pillers, monions for windowes, or other ornaments of burnt earth, artificiall marble, or things of burnt earth like marble; burnt earth like, burnt earth like free-stone, or other stone for building, or other uses; tiles, way-earthes, lime, plaisters, the making, moulding, perfecting and burning of certaine white earthen vessels, painted with diuers colours, commonly called by the name or names of Faianza

vessel ; and a certain earthen vessel of Jasper colour, or such as are brought out of the Straights, Italy, Spaine, France, Germany, and the Low Countries, together with pauing-tiles, chymney-peece, monions for windowes, and such other things framed and fashioned of earth, not usually heretofore made in any of his Majestie's dominions or countries : and all things whatsoever, made, or to bee made of earth and then burnt, or hardened.

All kind of presse-ware, to be made by presse and mould, or either of them and framed, and framed or fashioned of earth, or other stuffe or substance. Bricke may bee made of pit-cole or stone-cole, or any other of the priuledged fewels, better than with New-castle sea-cole, without danger of that losse which oft happeneth by New-castle sea-cole ; which as it is now used, doth many times spoyle much of the bricke-clampe by making it run together in a lumpe.

All boyleries, and hot waters, and all concrets gathered by boyleries, all copperosses allomes, salt-peter to bee made in one place continually, without trouble of digging houses, or stables being a new invention. Sugers, rosins, gums, turpentine, waxes, tallows, sopes, called white sopes, hard-sope, sweet-sope and castle-sope, not usually heretofore made in any of his Majestie's dominions or countries. Oyles,

distilled waters, commixtures, or all other boyleries, or directions whatsoever, heretofore boiled or heated usually with wood-fuell or char-cole.

Conuerting, or making of Iron into Steele, or Copper.

The burning of any weedes, or hearbes, or other things into ashes; or any stony. or glassy substance for dyers or glasse makers.

Extracts of siluer out of lead, or lead-ewre, or either of them, conuerting of lead or lead eure into litarge, or into white or red lead, or into cœruse.

A new deuised stuffe werewith ships, boats or other vessels, may be trimmed as cheape as now they are; and shall endure ten yeares together water-tite, without new dressing, or hurte by mosse, or wormes, so as they run not on graueley shelues; and will be exceeding good to preserue all timber workes from wormes and rotting, a small example, or parcell of the stuffe remaineth in custody of Mr. Ferroure.

A new deuised hard coniealed stuffe, which will make a liqor or commixture, which will fixe false dying woods, so as they will endure all cold wearing trials, and much more; as may appeare by a certificate made to the right Ho: the Lords of his Majesties most honourable Priuy Councell by the Lo: Mayor, and Recorder of London, on behalfe of that friend, by whose information the said Iohn Rovenson

attained to this new inuention: An ensample or parcell of this coniealed stuffe remaineth in custody of Mr. Ferroure.

All chymicall works, and operations whatsoever hitherto done usually by fire or wood, or char-cole, may by these new inuentions, meanes, instruments, or operations, bee made, wrought, or done by fire made with sea-cole, pit-colé, and other the priuledged fuels.

The models of all or most Engins, and instruments before mentioned remain in the custody of Mr. Ferroure, and had bene now expressed in print, but that the shortnesse of time limited for the impression hereof will not permit. To expresse the Furnaces by modell is needlesse, in regard that some of them haue been already set up by me the now patentee; and besides they may be varied into so many seuerall formes and figures, according to the seuerall formes and figures, according to the seuerall humors of the owners, as cannot be wele expressed by models.

The charge of an Iron-worke  
or Furnace.

I. A reasonable or conuenient house close by the mine, to set the furnace in, so as carriage of the Eure shall be thereby saued: the charge of that house cannot be great.

II. The furnace itselfe to work withall (which

shall do as much, or more than any furnaces now used with char-cole) may bee set up in the country, for less than ten pound charges, if their fire-stone bee not fetched too farre.

Upon decay of the furnace in the fire-stone or hearth, the one end of the furnace may bee pulled downe, and a new fire-stone or hearth put in, and the furnace re-edified and built all againe for forty shillings charge, or lesse.

The furnace being a winde furnace (which is best) saueth the charge of the bellowes, and of a milne to make them blow. And the engine to raise the hammer for the finery and chaffery by the help of one man, saueth the charge of the milnes for the finery and chaffery: and if the engine, finery and chaffery be set up in the place where the furnace to make Sow-Iron is, which may well be done; it will saue the charge of infinite carriage of Cole, stone, and Sow-Iron.

The Furnace may be so contriued that it may serue also for Finery and Chaffery; so as the Sow-Iron may be fined at one time, and in one and the same time, and in one and the same Furnace, where it is made Sow-Iron.

After the Furnace commeth to full heate which will be after 8 or 9 dayes, or fewer, heating and nealing by degrees, euery tun of Sow-Iron will not require

for the most part, aboue a Tun of pit-cole to be made  
withall.

Whereas an Iron-worke cannot be well  
set up and set on worke after the  
usuall manner without a  
1000 pound or 1500 pound  
dis-bursement and stocke ;  
now by this new Inuention  
an 100 Stocke will performe  
as much with Sea-cole  
and the new-deuised  
Furnaces hauing a  
conuenient house  
to set the Furnace  
In.







# **Metallica**

OR

## **The Treatise of Metallica**

Briefly comprehending the **D**octrine of diuerse new  
Metallical **I**nventions, but especially how, to neale,  
melt, and worke all kinde of mettles, oares, Irons,  
and Steeles with Sea-coale, **P**it-coale, Earth-coale  
and Brush Fewell.

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Also a transcript of his Maiesties Letters Patents of  
Priuledge, granted unto Simon Sturteuant for the  
said metallicall businesses for one and  
Thirty Yeares.

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**P**ublished in print before the last day of this present

[2]

Easter Terme, as the said Simon Sturteuant was by  
his Highnesse inioyned.

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Imprinted at London by

**George Eld.**

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Cum priuilegio

Anno 1612 May 22.

## **The Preface to the Reader.**

**G**entle Reader, I am not ignorant how they that are willing to apprehend and assist new businesses, are desirous to be satisfied in these points. First concerning the perfect and exact knowledge of that inuention, wherein they are to deale and negotiate, for as the common prouerbe saith—"Ignoti nulla cupido." The second is touching the worth and goodnesse of the businesse, and how the benefit thereof may bee raised. The third is the hability of the Inuentioner, to effect and perform his project propounded. The fourth is concerning the manner of contracting or bargaining; in all which I will endeauour to giue the best satisfaction that I may, out of the proœcepts and grounds of this present Treatise of Metallica. And therefore concerning the first point. The transcript of his Maiesties most gracious grant, and priuiledge doth evidently shew and informe the reader, that amongst many other inuentions granted for one and thirty yeares, my selfe, my executors, deputies, and assignes, may onely make, practise, and put in use, within any of his Maiesties realmes and dominions, the working, melting, and effecting of Iron, Steele and

other mettles with Sea-coale, or Pit-coale. The principall end of which inuention is, that the woods and timber of our country might be sau'd, maintained and serued from the great consumption and waste of our common Furnaces and Iron-milnes which as they are now ordinarily built and framed can burne, spend and consume no other fewell than char-coale. The which devise if it may bee effected accordingly (as I make no doubt but by Gods blessing I shall) will prooue to bee the best and most profitable businesse and inuention that euer was known or inuented in England these many yeares.

For (to speake nothing of the great benefit and profit which may be raised and made by twenty other inuentions comprised and comprehended under the patent) the yearly vallew of this mettle-businesse alone will amount virto 330. thousand pounds, per annus after the second or third yeare as appeareth by this calculation.

A calculation shewing how the mettle inuention or art, which maketh all kinde of mettles or metalique substance, with Pit-coale or Sea-coale, will be worthy per annum 330 thousand pounds, immediately after the two first yeares, which are the allotted times for tryalls and conformities without any charges, (except the charges of tryalls) to the patentees, partners, assistants, and dealers. There are planted already in

England and Wales, eight hundred milnes for the making of Iron, for there are foure hundred milnes in Surry, Kent & Sussex, as the townsmen of Haslemore haue testified and numbred unto mee, there are also 200 milnes in Wales, and 20 in Nottinghamshire, as the author hath been credibly informed.

Now wee may well suppose, that all England, Scotland and Ireland (besides the fore-named Shires) will make up the number of 180 milnes more, being in all 800 milnes. Moreouer one milne alone spendeth yearly in char-coale 500. pound and more, as diuerse clarks, and workmen in iron-businesse haue credibly testified which in pit-coale will be done with the charges of 30, or 40 pounds after the inuentioners manner and inuention or at the most with 50 pound where carriage is farre and chargeable.

So that the inuention in the 800 Iron-milnes, will saue and gaine—declaro—the owners of those milnes 320 thousand pounds yearly ower, and aboue their ordinary and annual gaines, as it appeareth by this proportion.

One milne  
alone saueth }  
yearely } 400 li

Ergo 800 milnes saue  
{ yearly 320 thousand  
pounds

Againe the said metallique inuention, beeing put and conuerted to lead, tinne, copper, brasse, and glasse-mettle, in all the seuerall mineralls of England,

Ireland, Scotland and Wales, will questionlesse cleare yearly, by meanes of fewell, aboue ten thousand pounds more; ouer and besides the ordinary gaines in the said businesse. So that the yearly Iron reuenues, added unto these other metalique reuenues, doe amount unto 330 thousand pounds, as was said before.

Now out of these metalique gains of 330. thousand pounds yearly, the ouners of the milnes, hearthes, and furnaces, may haue, and receiue liberall rates and allowed, and allotted unto them, ower and besides their ordinary gaines, onely in lieu of conforming their furnaces, fineries and chafferies to this inuention of pit-coale and earth-coale. And also the Kings most excellent Maiestie, the Prince his Highnesse the Duke of Yorke, the Lord Viscount Rochester and other parties interressed in the pattent, may by their composition and agreement with the said Owners and Iron Maisters, yearly receiue, by way of rents and licences, the residue of that gaines which remaineth ower and aboue that which was allotted and allowed to the Iron-Maisters, for applying of this inuention to their ordinary way of making of Iron, as more fully shall bee specified shewed, and prooued in the Appendix of this Treatise, which I am now preparing for the printer and the presse with all conuenient speed.



This may suffice therefore to giue the reader satisfaction, concerning the two first points, for the knowledge and the worth of the businesses, and concerning the manner how certain yearly annuities may be raised to the dealers and assistants.

Now to persuade the third point, that the authour is able to effect the worke undertaken, in as ample manner as he propoundeth : we plead and alledge as followeth.

First the inuentioner by his study, industrie and practise, hath already brought to passe and published diuerse proiects, and new deuises, and new proiects, as well literall as mechanickall, very beneficiall to the common-wealth. His literarie inuentions doe appeare and are knowne partly by his printed treatise of *Dibere Adam* which is a scholasticall engin aucomaton, and partly in diuerse other manuscripts which he hath to shew. His new mechanicks already performed, are to bee seene in the inuentions which he calleth by the names of presse wares, wood pleits, ballance, engine, baramyha, and Hubla, of all which in priuate speech hee is ready more largely to conferre, and to manifeste their truth and goodnesse at his worke-houses at Islington and Highbury. To conclude, therefore he doubteth not but (by Gods blessing & assistance, semblably with successe)

1 Sam 17. 34

Thus David reasoneth from  
the Beare and Lyon to }  
Golyah the Gyant . . . . . }

to effect his inuention of Iron-works, as also all his other metallique deuises and inuentions heere contained in the patent or priuiledged of metallica.

Secondly the consideration of thinges in the like nature with it, are good inducements to persuade well of this proiect, for brick-making, brewing, dying, casting of brasse-workes & were (not many yeares since) done altogether with the fuell of wood and charcoale, in stead whereof sea coal is now used as effectually and as to as good a use and purpose.

Againe (that which is somewhat neerer the marke) the blacksmith long agoe forged all his iron with char-coale (as in some places where they are cheape they continue this course still) but these many yeares small sea-coal hath, and doth serue the turne, as well and sufficiently,

Adde hereunto, that very lately by a wind-furnace, greene glass for windows, is made as well by pit-coale at Winchester house in Southwarke as it is done in other places with much wast & consuming of infinite store of billets and other wood-fuell.

Thirdly the inuention hath already experimented and made tryall of the chiefe particular meanes and instruments of diuers cheape waies of making Irons in reall and substantiall moddles to him-selfe (though in small thinges according as his meanes would giue him leave). And this of his credit and honesty he

auoucheth and protesteh: wherefore he more confidently presumeth to worke the same effects in grander instruments and means of triall, after that he hath receiued allowance of the dealers and assistants for it.

Fourthly there can bee no doubt of performing the matter propounded if the inuentioner can but make or cause Sea-coale to become as seruiceable for metallique purposes as wood & char-coale is. The art and skill whereof consisteth cheifly in three points: The first is to bring earth-coale to that equality of heat that wood or char-coale hath; That is to say, that it make neither hotter nor colderfier than the wood or char-coal doth: The second meanes is so to order and prepare pit-coale, that all malignant proprieties, which are averse from the nature of metallique substances, may be extracted from it, or at least destroyed in it. The third meanes is the addition and infusion of those deficient proprieties, which as they are in char-coale so ought they to be found in pit-coale.

Now this three-fold mistery and secret, the author can certainly perform and atchieue by the powerfull efficacie and meanes of his dexterous prerogatiue instruments, deuised for this purpose, as more at large is showed both in this treatise and in the appendix, which very shortly shall come forth, and also shall be further confirmed and justified by his daily experiments and tryals, which he will be ready to shew to them who

they shall any ways touch or concerne, or to them who are otherwise desirous to assist and deale for the experimenting and accomplishing of these so worthy good businesses. And then also they shall know my purpose for contracting and bargaining by word of mouth, as it is best fitting for priuate dealings and negotiatings.

And thus (hauing briefly touched these foure promised points) I conclude and shut up this Preface of Metallica. Humbly and unfeignedly beseeching the Lord, who by His Holy Spirit inspired \* Bezaleel,

Aoliah and Hiram with the light of Exod. 31. 1, 2. Mechannical inuentions, and in all manner 2 Cro. 2. 7. 14. of workmanship, for his effectuall Nisi dom: oedi ficauerit blessings in these our enterprises, that Psalm 127 which was begun in his feare, may be prosecuted and fully accomplished and built by his heavenly & helpful hands, to the glory of his name, and for the good-well-fare and emolument of the Kings most Excellent Maiestie, the Church and the Political estate wherein we liue—Amen.

*Simon Sturtevant.*

# Metallica

## CAPUT I.

The Transcript of his Maiesties Indenture.

### Reader.

**A**s I understand you haue promised and couenanted in your pattent more fully and euidently to expresse and enlarge in a printed treatise to be called metalica, euery point and part of your priuiledged businesse, to the intent that the reader might the better conceiue and judge of the inuentions propounded, and might the sooner also bee induced to assist, and set forward, so good and worthy workes: first therefore I demand of you by what name and appellation you entitle that generall head, under the which you reduce and comprehend all the seuerall arts and inuentions of your pattent.

Author. The generall, that comprehendeth all the other perticular inuentions, is called Metallica, which is a word deriued and deduced from the Greeke and Latin words Metallon and Metallum, which signifie in English, mettles, which properly are minerall substances, digged and taken out of the earth, of which sort are, Iron, Lead, Tin, Copper, Brasse, Gold and Siluer &.

R2. Doth your Pattent of Metallica onely containe the makinge of mettles by the meanes of Sea-coale and Pit-coale, and with your other Metallical instruments which you have deuised for that purpose.

A. His Maiesties grant is very large and ample, for it doth not only comprehend and priuiledge the making of all kinde of mettles, after the manner prescribed, but also equally authorizeth and licenseth any other mechanick inuentions comprehended under the generall definition of Metallica which is mentioned in the Schedules or Manuscript treatise annexed to the pattent, which Schedules haue the same force and validitie as his Maiesties Indenture itself.

R3. Then that I may certainly know and understand the extent of your priuiledge, repeate I pray you word by word, defenition of Metallica, as it is written in the said Schedules, annexed to your pattent.

A Metallica — mentioned in the petition, is thus defined. Metallica is an art or inuention, showing how diuerse things and materials, now made and attained unto, in a very chargeable sort, after the ordinary way, may be made and attained to after a more cheaper manner, and as with the helpe of common instruments: so more especially by diuerse new deuised metallical instruments and meanes.

From these metallical instruments, the art is generally called metallica.

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R4. This summary definition giueth me some general light and understanding into your businesses, but that I may be the more fully satisfied, I pray you rehearse also the tenour of his Maiesties grant, as it is under the broad seale of England.

*James.*

# A Letter Pattent

James R.

**T**his Indenture made the xxix. day of February, in the yeares of the Reigne of our Soueraigne Lord Iames by the grace of God, King of England, Scotland, France and Ireland the ninth & of Scotland the xlv. Betweene our said Soueraigne Lord, of the one party, and Simon Sturteuant gentleman of the other party.

Whereas, the said Simon Sturteuant, by his long study and great charge, hath attained unto diuerse new exact Mechanick, Arts, Mysteries, Waies, and Secrets of his own inuention, whereby all kind of mettles, workes and other things and materialls, as namely, Irons, Steels, Leads, Tins, Coppers, Brasses, and such like—Secondly, all kind of Metallique concoctions, as Sand-mettles, Ash-mettles, Ammels, and such like. Thirdly, all kinde of Burnt-earths, as Tiles, Pauing-stones, Bricks, and such like. Fourthly, all kind of Press-wares, as Prest-tiles, Prest-bricks, Prest-monions, Prest-stones and such like with diuerse other things and materials now made after the ordinary course, with wood-fewell and charcoal may be as well made, wrought and effected, as the said, Simon Sturteuant affirmeth with Sea-coale, Pit-coal, Earth-



coal, and Brush fewell, whereby the woods now generally wasted, in all the chiefe wood-land countries of this realme of England by iron-milnes and such other Metallical Furnaces and hearths, may preserved from the great consumption thereof and saued from like inconuenience in other his Maiesties dominions, all which premises, so by this new inuention to be made, the said Simon Sturtevant hath undertaken shall be in substance and for use as sufficient and as good as the other like Materialls now made and wrought with the chargeable and excessive waste of wood and charcoale. And, whereas, also, the said Simon Sturtevant, for the better making, working, and effecting, beating, burning, melting, the said mettals, workes, things, and materialls, by and with Sea-coale, Pit-coale, Earth-coale, and Brush-fewell, hath by his said inuention and skill, inuented dieurs Furnaces, hearths, tests, tooles, engens, milnes, and other instruments and meanes, new, and of his oune inuention, neuer heretofore used or put in practise by any other. And hath also by his said inuentions and skill, attained to the knowledge how to use and employ diuerse other common instruments, to the making, working and effecting the said mettles, workes, materialls, and things, which other common instruments haue bin heretofore, and are used in other arts, sciences, and manuel occupations, but were not, nor haue bin as yet conuerted, used or

employed, to, for, or about the making, working effecting & producing the said mettles, workes and things: which said skill & inuentions of the said S. Sturteuant & the said mettles, workes, things, and other materials, and the meanes and instruments whereby to worke and effect the same, are in some measure mentioned and expressed in the Schedule or Schedules, to these presents annexed, and shall be more fully, amply, and particularly demonstrated, specified, described and contained in a large Treatise, which the said Simon Sturteuant hath already conceiued, and shall bee put in print, and so published before the last day of Easter Terme next ensuing the date hereof, which treatise so to be printed, shall be intituled—A Treatise of Metallica: which said inuentions of the said Simon, may and will prooue beneficiall to the Common-wealth, both in regard of the abundant plenty of the said things and materialls which it will daily bring forth, as also because it saueth and preserueth abundance of Timber, Char-coal and Wood-fewell and other things and commodities wastefully consumed and spent, the generall want whereof already is felt. And, for as much as our said Soueraigne lord is given to understand that this art, skill, industrie and inuentions of the said—Simon Sturteuant, of making, casting, founding, working and acquiring of the afore-said mettles, and workes of Iron, materials, & things

by Sea-coale, Pit-coale, Earth-coale, and Brush-fewell, and all and euery, or any of them, and also the making of the said new deuised engins, hearths, furnaces, and other meanes, and instruments, and the imploying of the said instruments used in other sciences and arts, to the making, working, effecting, and producing the said Mettalls and other workes, materialls and things, is a thing not yet practised, nor brought into any trade, occupation or mysterie, within any of his kingdomes, but is an inuention in substance new, and which shall not preiudice or cross any from preiudice or crosse any from priuiledge or grant by his Maiestie heretofore made or granted under the great seale of England, for the using and making of any former inuention, and therefore fit to bee priuiledged for a certain time, the rather for that his Highnesse conceuieth, that the said inuentions and skils, may and will become profitable and good for the common-wealth of these realms, and also augment his customes and impost, in regard it bringeth forth great and abundant store of the afore-said Materials and things, not onely for the use of his Highnesse realmes and dominions here at home, but also for trafficke and Marchandize into forraine contries abroad, which are customeable. In regard whereof and also for, and in consideration of the good, faithful seruices heertofore done and performed unto his said Maiesty by the said Simon Sturtevant, as also to the

end that the said Simon Sturtevant may receiue some coneuient recompence, benefit and profit for his said seruices, as also for his studies, laboures and charges in perfecting these inuentions to the common-good which may ensue heereby to his Highnesses Realmes and Dominions.

This indenture witnesseth thait our said soueraigne lord the King of his especiall grace, and containe knowledge and meere motion, and of his prerogatiue royal, hath guien and granted, and by these presents for him, his heirs and successors, doth giue and grant, unto the said Simon Stutevant, his executors, administrators and assignes, and his, and their deputy and deputies, the sole, full, absolute and free power, liberty and authority, to make, worke, produce, acquire and bring forth, all kinde of the aforesaide mettles, and other the materials, and things, by and with Sea-coale, Pit-coale, earth fewell, and all euery, and any of them, in all parts and places of his Maiesties realmes, of England, Scotland, Ireland, & Wales, and also within all the same places and dominions, to make, frame, erect, acquire and prouide, or cause to bee made, framed, erected, acquired, and provided, all necessary instruments and meanes. As namely, all work-houses, furnaces, hearths, milnes, structures, engines, vessels, tests, tooles, instruments, deuises, or things of iron, or other stuffe or substance, whatsoever, which are al-

ready in use, in any other trade, mysterie, arte, or occupation, and as yet not exercised or used, in, or about the making working, casting, founding, or acquiring, and producing of the sayd mettles and other materialls and things, for, and to the end and purpose aforesaid, viz: to make, worke, and effect the said mettles, and other materialls, and things by, and with Sea-coale, Pit-coal, Earth-coale and Brush-fewell and all, euery, or any of them. And also in all the said places and dominions, to make, frame and erect, use and imploy, or cause to be framed and erected all the said new Furnaces, hearths, deuises, instruments and meanes, which are meere of the new inuention of the said Simon Sturtevant to, for, in, or about the making, working, casting, founding, acquiring and producing of the said mettles, and other the said materials and things, and to all or any other purpose use or uses, whatsoever, in as ample sort or manner as they or any of them are described, expressed, or mentioned in the Schedule to these presents annexed, or shall be more fully demonstrated, specified in the Treatise of Metallica, which shall bee as aforesaid Printed before the last day of Easter Terme next ensuing. And our said Soueraigne Lord doth further by these presents, for him, his heires & successors, assigne, appoint, ordaine, constitue, licence and authorize the said Simon Sturtevant, his Executors, admin-

istrators, and assignes, to haue the sole power, liberty, and authority, by and with Sea-coale, Pit-coale, and Brush-fewell, and all euery, or any of them, and by his said inuentions, arts and skills inuented and deuised for the making of all kinds, of the said mettles and other materials and things, and also for the making, framing, and erecting of all such instruments and meanes, as Worke-houses, Furnaces, Milnes, Quernes, Structures, Engins, Vessels, Tooles, Instruments, Deuises, and things heretofore used in any other Arts or Sciences, to bee imployed or used in or about the making, working or producing the said mettals, things, and materials, or any of them, as aforesaid, and also to haue the sole power, liberty, and authority for the making, framing, erecting, or producing of all the said new deuises, instruments, and meanes Metallical, as aforesaid, in what sort, or about what thing so euer the same or any of them shall bee used or imployed : and that the said Simon Stutevant, his executors, assignes, administrators & their deputy & deputies & none other without his, or their speciall licence or toleration, shal or may make any kind, or kinds of the said mettles & other the materials and things, by, or with Sea-coal, Pit-coal, earth-coal, and brush-fewell, or at, some or any of them, by means of or by using & imploying the said inuentions of the said Simon, or any part or parcel of the, or any of the, or make, frame, & erect,

any the said workhouses, furnaces, hearths, milnes, structures, engines, tests, vessels, tooles, instruments, deuises & things heretofore used in any other arts, or sciences which by the said inuentions of the said Simon, shall be transferred or conuerted, or turned to be used exercised, and imployed, in, or about the making, casting, founding, working, acquiring, and producing of the said mettles or materials, things and deuises, by, or with Sea-coale, Earth-coale, Pit-coale, and Brush-fewell or all, some, or any of them, or to make, frame or erect, any of the said new deuises instruments and means of the said Simon, either to the making, casting, working, or effecting, all or any of the said works, mettles, or materials, by or with Sea-coale, Earth-coale, and Brush-fewell, or all, some, or any of them, or to any other end or purpose whatsoever. To haue and to hold, use, exercise and enioy, the sole making, casting, founding, working, tempering, acquiring, and producing of all and euery the said mettles, and other the said premises, in manner and forme aforesaid, and to the end and purposes aforesaid, unto the said S. Sturtevant, his executors, administrators, or assignes and by his and their deputy and deputies, for and during the time and terme of 31 yeares, now next coming immediately from & after the date of these presents. Yeelding, rendring & paying therefore, yearly & euery yeare immediately

from, and after the date hereof, for and during the said terme of 31 yeares, to our said Soueraigne lord, his heires and successors, at the receipt of his Highesse Exchequer at Westminister, alwaies in the terme of St. Michael, ten parts of such sum or sums of money, and other cleare yeerely profits, in 33 parts to be deuided as he the said Simon Sturtueant, his executors, administrators, or assignes, shall yearely haue or receiue, during the said terme of 31 yeares now next coming and by way of composition or otherwise, for, or by making, framing, or erecting, casting, founding, and acquiring, or otherwise for licencing, or authorising any person or persons whatsoever, to make, frame, cast, erect, found, or acquire, any of the said materialls, worke-houses hearths, milnes, structures, furnaces, engines, vessels, tests, tooles, instruments, deuises, and thinges aforesaid, the charges and expences in and about the same, and euery of them, expended out of the said thirty-three parts alwaies deducted and allowed to the said Simon Sturtevant his executors, administrators and assignes. And likewise yeelding, tendring, and paying unto the most excellent Prince Henry, eldest sonne of our said Soueraigne, Lord, Prince of Wales, Duke of Cornwall, and Earle of Chester & his executors, or administrators, yearly and euery yeare, during the said terme of one and thirty yeares, in the same termes of St.



Michaell five parts of the said summe, and summes  
 of money, and other cleere profits in thirty three  
 partes to bee deuided, to bee alwayes paid and de-  
 liuered to such person or persons as the said most  
 excellent Prince shall appoint to receiue the same, at  
 his highnesse pallace of St. Iames in the county of  
 Middlesex. And also yeelding, rendring, and paying  
 unto the most high and mightie Prince Charles Duke  
 of Yorke; second sonne of our said Soueraigne Lord,  
 unto his executors and administrators during the said  
 tearmes of thirty one yeares in the said tearmes of St.  
 Michaell the Arch-angell two parts of the said summe  
 and summes of mony and other cleare profits afore-  
 said in 31 parts to be deuided, to be alwaies paid and  
 deliuered, at the said pallace of St. Iames, to such  
 persons or persons as our said Soueraigne Lord the  
 King, during the mynority of the said Duke of Yorke  
 and after his full age hee the said Duke shall appoint  
 to receiue the same: And moreouer yeelding, rendr-  
 ing, and paying unto Robert Vicount Rochester Baron  
 of Wainick his executors and administrators in the  
 same termes of St. Michaell one part of the said sum  
 and sums of money and other cleere parts to be deu-  
 ided. And as concerning the residue of the said summe  
 and sums of money, and other cleere profits to be  
 deuided, it shall and may bee lawful to, and for the  
 said Simon Sturteuant, his executors, administrators,

and assignes, to retaine and keepe one part thereof to his and their discretion, and in such manner and forme, and by such rates and proportions, as he, and they, shall in their discretions thinke meet to dispose thereof and to expend and to distribute the same, and euery part and parcell thereof, amongst such persons, or persons, as shall aduenture, ioyne, be assisting, aiding or helping to the aduancing, or setting forwards of the workes and inuentions afore-said, or any of them, and amongst such person or persons as shall be ouners of the said work-houses, furnaces, hearthes, milnes, structures, engins, vessels, tests, tooles, instruments, deuises, and things beforementioned, or any of them.

And the said Simon Sturtueant, for him his, heires executors, administrators, or assignes and for euery of them, doth couenant and grant, by these presents, to, and with, our Soueraigne Lord, his heires and successors, that he the said Simon Sturtueant, his executors, administrators, or assignes shal and wil, yearely and euery yeare during the said terme of one and thirty yeares, well and truly yeelde, render satisfie, content and paye, or cause to bee contented and payed, the said tenne parts of the said cleere profits, in manner and afore said unto our Soueraigne Lord, his heires and successors, and shall and will likewise during the aforesaid terme of one and thirty yeares, well and truly yeeld, render, satisfie, content and pay unto the

said Prince of Wales, his executors or administrators, the said five parts of the said cleere proffits, in manner and forme afore-said. And also to the said Duke his executors or administrators the said two parts of the said cleere proffits in manner and forme aforesaid. And also to the said Duke his executors or administrators the said two parts of the said cleere proffits in manner and forme afore-said. And also to the said Lord Viscount Rochester, his executors or administrators the said one part of the cleere proffits in manner and forme as the same one part is formerly in these presents appointed to bee yeelded, rendered and payed to the said Lord Viscount Rochester, his executors and administrators; and for asmuch as when the said skill, worke and inuentions of the said Simon Sturtueant, which hereby his great industry, cost and expenses hath attained to, shall appeare and bee made commonly knowne, it is very likely that many persons will priuily of the said Simon Sturtueant his executors, administrators or assignes, make, frame and erect the like, and peraduenture hauing his platforme, adde there unto some further new inuention for their gaines, or otherwise put the same in practise at their pleasure, and make the said mettles and other materials and premises aforesaid, thereby reaping the fruits of the labours of the said Simon Sturtueant, and so defraud both our Soueraigne Lord and the said Prince, and

the said Duke of Yorke, and the said Lord Viscount Rochester, and also the sad S. Sturtueant his executors, administrators & assignes and such others as shall aduenture therein of a great part of the benefit and profit which might otherwise accrue unto our said Soueraigne Lord, and to the said most excellent Prince and Duke of Yorke, and to the said other parties by such skill, worke, and inuention aforesaid. Our said Soueraigne Lord therefore fauouring the good endeouours and studies of the said Simon Sturtueant in the premisses, and his former seruice done unto his Highnesse, for him, his heires and successors, for the better encouraging of him the said Simon Sturtueant, his executors administrators and assignes, in the same, and the better to enable him to under-goe and beare the burthen and charge thereof and to avoid all deceit that and waye may hinder our said Soueraigne Lord, or the said most excellent Prince, or Duke of Yorke or any of the said parties aforesaid, doth by these presents declare and signifie, that his maiesties royall will and pleasure is, and our said Soueraigne Lord doth hereby streightly will, and command all and euery person or persons, of what state, degree or condition, soeuer, that they nor any of them during the said terme of one and thirty yeares, shall not presume or attempt, by any art, deuise, skill, or cunning, directly or indirectly, without the speciall

licence, allowance, and consent of him the said Simon Sturteuant, his executors, administrators, or assignes, or of his, their deputy, or deputies, there-unto by him or them lawfully authorised, to make, frame, erect, contriue, or performe any kinde, or kindes of the aforesaid mettles, and the other materialls and things or any of them, by or with Sea-coale, Earth-coale and Brush-fewell, and all or any of them, or any of the said new deuised instruments, and things, either too, or about the making or working the said mettles, things, and materials, as aforesaid, or to any end or purpose whatsoever, or to make or doe any act or thing, whereby, or by meanes whereof, our said Soueraigne Lord the King, or the said most excellent Prince of Wales, or the said Duke of Yorke, or the said Simon Sturteueant, his executors, administrators, or assignes, or other the said parties, shall or may sustain any preiudice, losse, or detriment, in the said inuentions or workes, or in any profit or commoditie which they or any of them may or might otherwise, receiue, or enioy by meanes of the same inuentions or workes, or any of them upon pain of the high displeasure of our said Soueraigne Lord the King, and upon paine of imprisonment of their bodies, and forfeitures of all, and euery the said materials, instruments, and things aforesaid which shall be wrought, framed, and made by any person or persons contrary

to the tenour of these presents and Royall prohibition therein, with such further penalties, pains and forfeitures, as by the law and statutes of the said Realms can, or may be inflicted upon them, or any of them, for their wilfull and obstinate disobedience, and contempt of his Highnesse said commandment and prerogative Royall. And it shall happen that any person, or persons, contemptuously neglecting this his maiesties will and pleasure, in these presents declared after notice thereof giuen, shall make or acquire any kind or kinds of the aforesaid mettles, and other the materials and things, by or with Sea-coale Pit-coal, Earth-coal, and Brush-fewell, or all, some, or any of them, by any of the said meanes and inuentions, or any part or parcell of them or any of them, or shall frame, worke, erect, use or employ any such or the like engins, instruments, tools, instruments, for and to the purpose and purposes aforesaid, the same and all, and euery of them shall be taken and seized, by the Constable or other officer, dwelling neerest thereunto, to, and for the only use and behoofe of our said soueraigne Lord the King, his heires and successors, and further our said soueraigne Lord the King of his abundant grace, certaine knowledge and meere motion doth by these presents for him, his heires and successors, giue and grant full power and authority to the said Simon Sturtevant his executors, administrators,

and assignes and his and their deputy and deputies and euery of them with the assistance of a Constable, Tithing-man headborough, or any other ordinary officer in any citty, towne, place or places, as well within the liberties, as without, within the said realmes and dominions at all and euery time and times, to haue accesse and entry into any house, place, and places, where such mettles and other the premisses shall be made and wrought or otherwise layd up contrary to his maiesties grant, and there to search and prouide and see that during the period 31 yeares no manner of such or the like inuentions workes, or practizes, of making, or erecting any kind or kinds, of the said mettles and other the premisses to be made, wrought sold, used, or imployed within the said realmes contrary to the true meaning of these presents, and by all lawful and conuenient waies and meanes to search, see examine and find out, all offences during the said time that shall be committed contrary to any guilt, licence, authority and commandment, prohibition, or other thing in these presents mentioned, specified, and to seaze as aforesaid, such instruments and other things aforesaid whatsoeuer, made, framed, or erected, used exercised or occupied contrary to the true intent of these presents or any clause herein contained. And his Highnesse will and pleasure is, and by these presents for him, his heirs

and successors, his maiestie doth streightly charge and command all Iustices of peace, Maiors, Shereffs, Bailifes, Constables and al other officers, ministers and subiects of his Highnesse, his heires and successors for the time being, that they and euery of them, during the said terme of 31 yeares, or the duplicate exemplification or the enrolement thereof, shall be aiding and assisting to the said S. Sturteuant, his executors, administrators, assignes & deputies & euery of them in the due execution of all and euery the said grants, authorities, commandments, licences, priuiledges, inhibitions, prohibitions, and euery other thing in these presents mentioned and specified, or any of them. Provided alwayes that this indenture not anything nor anything therein contained, shall extend or be construed to extend, to restraine or hinder any person or persons, for exercising or using any of their oune inuentions or artes heretofore exercised, put in use or priuiledged, by any of his Maiesties Letters Pattents, heeretofore made & granted to them or any of them, but that it shall and may bee lawfull, to and for all and euery the said person or persons, to exercise, use and put in practise all and euery the said inuentions heeretofore practized, put in use, exercised and priuiledged by any of the said Letters Pattents to them or or any of them, made or granted in as ample sort, and manner as they might or may exercise, practise, or use



the same if these presents had neuer beene had or made any in these presents to the contrary notwithstanding. IN WITNESS whereof to the one part of the Indentures remaining with the said Simon Sturteuant our said Soueraigne Lord the King's Maiestie, hath caused the great seal of England to bee put, and to the other part thereof remaining with our said Soueraigne Lord the King, the said Simon Sturteuevant hath put his seale. Yeouen the daye and yeare first aboue written.

EXAM. *Henry Hubbers.*

## The Docquet to the Pattent.

**T**his is your Maiesties part of the Indentures whereby your Highnesse doth grant, licence and priuiledge unto Simon Sturteuant gentleman, that he is executors, deputies, and assignes onely, and none other, shall and may, during the terme of 31 yeares, make, practise, and put in use within any of your Maiesties realmes and dominions certaine inuentions, furnaces and instruments deuised, and inuented by himselfe, for the working and effecting with Sea-coale, Pit-coal, Earth-coal and Brush-fewell, diuer things and workes done heretofore with Wood-fewell, as namely, Irons, Steeles, Leads, Tins, Coppers, Brasses, Glasse-mettles, Mines, Tiles, Bricks, Potter-ware and such-like. And there is reserued to your Maiestie upon this grānt ten parts in thirty-three parts, to bee deuided of the cleare yearely profits that shall bee made by the said inuentions: and to the Prince his Highnesse, fīue of these parts: and to the Duke of Yorke two of those parts, and to the Lord Viscount Rochester, one of those parts; and to the said S. Sturteuant one or other of those parts, and to the disbursers of the money for the tryall and effecting of the said

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inventions, fourteene such parts, and the declaration and discovering of this invention, is partly set down in a certaine schedule, which is to bee annexed to these indentures. And the full and plain manifestation thereof is to bee set forth in print, by the said Simon Sturteuant before the last day of Easter terme next, and containeth a prouisor, that this new grant shall not crosse any former grant heretofore made to any others.

And is done upon signification given unto Christopher Perkins, Knight of your Maiesties good pleasure in that behalfe.

Exam. Henry Hubbers.

It is his Maiesties pleasure that these doe passe by immediate warrant.

Robert Salisbury.

Received 29 of February 1611.

An Indenture betweene the Kings

Maiestie an S. Sturteuant.

Coppin.

**The Manuscript Treatise of  
Metallica,**

CAPT.

**Reader.**

**I**n the Transcript of his Maiestie's Indenture, which you have rehearsed there is further refference unto a manuscript treatise, or certaine schedules which are annexed unto the grant, which I pray you also rehearse unto me, according to the tenour of the words in the originall.

A. The manuscript Treatise of Metallica, which otherwise is termed by the name of schedules in the indenture, is comprehended in these ten sections following.

**SECT. I.**

**Metallica the generall  
of all Metallical Arts.**

Metallica, mentioned in the petition, is thus defined—

Metallica is an art or inuention shewing how diuers things and materials now made and attained unto in a very chargeable sort, after the ordinary way, may be

made and attained unto after a more cheaper manner, and as with the help of common instruments, so more especially by diuers new deuised Metallicall Instruments, and meanes, as in the Printed treatise of Metallica, more at large shall bee mentioned and expressed.

From these Metallical Instruments the art is generally called Metallica.

The doctrine of Metallica cannot be distinctly known or methodically expressed, except that the Art which prescribeth precepts, general to all Arts and Inuentions called Heuretica be first precognized.

#### R. Define Heuretica.

Heuretica is the art of Inuentions, teaching how to find out new, and to iudge of the, old and so forth, as followeth in the printed treatise of Metallica—Metallica, thus generally described is of two sorts, Ignemetallica, which worketh with fire and hearth, or Inigmetallica, which useth not the meanes of fire, for to attaine to the thinge or materiall intended, yet it useth the other Metallicall Instruments, whereupon it is called more properly Metallorganica. Ignemetallica, comprehendeth many generall inuentions, which are reduced into these 7 heads, first Metallica, propriè dicta, secondly, Pressoria, thirdly Terrica, fourthly Hydrellica, fifthly Hydrometallica, sixthly Hydropressoria, seauenthly Hydroterrica.

**SECT. II.****Metallica proprie dicta.**

**Metallica** in the proper and strict signification is thus defined.

**Metallica** is an Ignick inuention for the cheaper making of all kindes of mettles or Metalique concoc- tures, by the meanes of cheape firing, and other Metallical, instruments, where-upon the materials and things made by this Arte, are called Metaliques.

The contens of **Metallica**, proprie dicta,  
in the seuerall Materials which the

Art maketh.

- |   |   |                                    |   |   |
|---|---|------------------------------------|---|---|
| The Metal-<br>ique<br>Materials<br>are as | { | I.<br>All kind<br>of<br>Mettles as | { | <ol style="list-style-type: none"> <li>1. Prepared or roasted oares<br/>Mine-stones, or Mettle-<br/>stones beeing the fit matter<br/>of Metallique liquours.</li> <li>2. Irons, Steelees.</li> <li>3. Leads.</li> <li>4. Tins.</li> <li>5. Coppers, Bras'es.</li> <li>6. Any other new kind of<br/>mettles which may here-<br/>after bee found beeing<br/>made and wrought after<br/>the said Simon Sturteuant<br/>his manner and Inuention.</li> </ol> |
|---|---|------------------------------------|---|---|

7. All compounded mettles of  
the same kind, as, Pewters, Belmettles, Sodars, Candle-  
stick mettle, beeing made and wrought after the said  
Simon Sturteuant his manner and inuention.

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All kind  
of Metalique  
Concoctures  
&  
their co-  
creats as

1. All kinde of Sand-mettles,  
or Ash-mettles.
2. All kind of Ammels, Beugles,  
or such commixtures.
3. All kinde of Metallique  
Slagges, or cinders, if (per-  
haps they may bee turned  
to some profitable use.
4. Other compounds of the fore-  
named concoctures, beeing  
made & wrought after the  
said S. Sturteuant his man-  
ner and inuention.

And so forth, as it shall be further mentioned and  
enlarged in the Printed treatise of Metallica.

### SEC. 3.

#### Metallical Instruments.

The instruments and meanes Metallicall, which are  
used for the producing of metallique materials or  
things, are of two sorts, common or peculiar.

The common instruments are such which are bor-  
rowed from other trades, occupations and mysteries,  
amongst which we have especially use of Ioyners,  
Smiths, Turners, not onely of their Instruments and  
Toolles, but also of their Emporeuticks, which they  
ordinarily make as, Presses, Vices, Screwes, Bellows,  
Tongs & made either of Iron and Wood, or of both  
together.

The peculiar instruments are those that are of the authors inuention, beeing of chiefe and principall use for the working of Metalllicall effects.

The peculiar instruments of inuention are principally of three sorts—Lenick, Plegnick, and Caminick.

Lenicks are peculiar Metalllicall instruments which worke their operation and effect by pressing, impres-suning, or moulding, and that either by thrusting or drawing all the kindes of these Lenick instruments, are at large described in the doctrine of art Presoria which is a part of the Printed Treatise of Metallica.

There is a great use of these Lenick instruments, for the tempering and commixing of Sea-coale and Stone-coale.

Plegnicks are peculiar metallical instruments which perform their operation and effect, by their dexterous and artificiall ioynt moouing.

All the kinds of plegnick instruments, are at large described in the doctrine of the arte Plegnica, which is part of the Printed treatise of metallica.

There is a great use of the Plegnick instruments for the making of Eumechanick and reformed Milnes & Bellowses.

Caminicks are peculiar metalllicall instruments which perform their operation and effect by the new kind of Furnacing and Hearthing.

All the kinds of Caminick instruments are at large



described in the doctrine of the art Caminica, which is part of the Printed treatise of metallica.

The instruments metallical, although they are of cheefe use in all the metallicall arts, yet are they more peculiarly belonging to metallica proprie dicta, and for this cause, they are annexed to it.

And so forth, as it shall be further mentioned, and enlarged in the printed treatise of

## **Metallica.**

### **SEC. 4.**

#### **PRESSORIA.**

Pressoria is a kind of Ignick Inuention, which by the meanes of cheape fiering, and by other Metallicall Instruments and meanes, maketh all kindes of Press-wares or Mould-wares.

Press-ware, or Mould-ware is anything that can bee made, wrought or formed of clay and earth, not by hand and (as the Potters use) but by Presse and mould, or by pressing and moulding and that by the helpe of metallicall Instruments and meanes.

There be many sorts and kindes of Press-wares by by reason of different figures and diuers uses into which they are to bee applied, all which kind are to be reduced to these two heads of Rude-ware and Polisht ware.

Rude-ware are such sort of Press-ware which after they are pressed and moulded require no further ornament; as Prest-pipes, Prest-tiles, Prest-brickes, Prest-stones: and such like Expressed in the Printed Treatise of Metallica.

Pollisht-ware, are such sorts of Press-wares, which after they are pressed and moulded, doe receiue further ornament or beauty, as prest-monions for windowes, and prest-columns, and such like, described in the Printed Treatise on Metallica.

## SEC. 5.

### TERRICA.

Terrica is an Ignick Inuention, for the cheaper making of all kinds of Burnt-earths, by meanes of metalllicall instruments, whereupon the materialls made by this Art, are called Terricks.

The contents of Terrica, in the seuerall Materialls which the art maketh.

1. All bricks burnt or baked, after the said S. Sturteuant his manner and inuention, though made and moulded according to common order of Brick-makers.

The Terrick  
materials, are  
all kinde of  
burnt Earth  
as.

[41]

2. All kinde of Tiles burnt or baked, after the said S. Sturteuant his manner and inuention, though made and moulded according to common order of Tile-making.
3. All kind of Potter-ware burnt or baked after the said S. Sturteuant his manner and Inuention, though moulded according to common order.
4. All kinde of Limes, plaisters alabasters burnt, after the said S. Sturteuant his manner and Inuention.
5. All kinde of Way-stones, Way-grauels, Way-earths, burnt and made after the said S. Sturteuant his manner and Inuention, this Art is called Itineraria.
6. Lastly, any other kinde of burnt Earths, that here-after may be deuised, as good and proper for the Common-wealth, being made burnt and wrought, after the said S. Sturteuant, his manner and Inuention.

R

And so forth as it shall bee further mentioned and  
Enlarged in the Printed Treatise of Metallica.

## SEC. 6.

### HYDRELICA.

Hydrelica is an Ignick inuention, for the cheaper  
making of all kinde of hotte liquids, or liquoures, by  
the meanes of metalllicall instruments, whereupon the  
materialls made by this arte are called Hydrellicks.

The contents of Aydrelica in the  
seuerall Materialls which the  
Arte maketh.

All kind of Hy-  
drelick waters  
& their ancreats  
of which there  
are diurse sorts  
as.

1. The Hydre-  
lick materials  
are as.

1. All bathing waters for the wash-  
ing of the body.
2. All kind of washing, scouring  
waters for washing of foule ves-  
sels, foule linen and other cloth
3. All kinde of hot-brine, or liquor  
for makeinge of beare or ale, or  
any other kind of Beauoridge.
4. All kinde of hot or warme waters  
for dying cloth, silke, or leathers  
&.

5. All kind of hot-waters, for other trades, occupations or mysteries, as the Treatise further Expresseth.

2.  
All kind of Hydrellick unctions, liquids or liquours which flame or burne, and their concreats—as.

1. Oyles, Tallowes, Fatts, marrowes, and such like.  
2. Waxens, Rosens, Pitches, Tarres, Turpentine, brimstones & such like unctions, gummies.

3.  
All kind of Hydrellick liquors which are mixed and compounde of waterish and unctious liquors, and their concreats—as.

1. All kind of Sopes, whether they bee black-sopes, sweet-sopes, or white-sopes.  
2. Any other compound Hydrellick, which hereafter may bee deuised or found out by the said S. Sturteuant his Inuention.

And so forth, as it shall be further mentioned and Enlarged in the Printed Treatise of Metallica

## SEC. 7.

### HYDROMETALLICA.

Hydrometallica is an Ignick inuention, which with the same furnace maketh at the same time, Metallique materialls, made and brought forth by this art, are

procreated as pares, twins and couples, and are called from hence Hydrometallicks.

The contents of Hydrometallica, being an inuention compounded of two kinds, is diuers and manifold according to the seuerall coupling and ioyning of the opposite simples together.

As for  
Example.

1. Prest-pipes and hot-waters.
2. Prest-tiles and hot-waters.
3. Prest-bricks and hot waters.
4. Prest-monions and hot waters.
5. And such like combination and couples.

And so forth, as it shall be further mentioned and enlarged in the printed treatise of Metallica.

## SEC. 9.

### HYDROTERRICA.

Hydroterraica is an Ignicke inuention, which with the same fire and the same furnace maketh at the same time Terricke materials, and Hydrelicke materials both together, by meanes of metalllicall

instruments whereupon the materials made and brought forth by this art, are procreated, as pares, twins, or couples and are called from hence Hydroterricks.

The contents of Hydroterrica being an inuention compounded of two kinds, is diuers and manifold according to the seueral coupling, and ioyning of the opposite simples together, as.

Burnt-Earth, and hot water.

As for  
Example.

1. Bricks and hot water.
2. Tiles, and hot water.
3. Potter-ware and hot water.
4. And such like combination & couples.

And so forth as it shall be further mentioned and enlarged in the Printed Treatise of Metallica.

NOTE also that the compound arts, being rightly and discreetly performed, are farre more profitable than the practise of the single arts alone, and the reason is because that by such a compound furnace, two different workes are done at once, and in a manner with the same charge.

And these are the seuen seuerall heads, and kindes of inuentions : The general whereof is called Ignimetallica.

There are also other diuers other new arts, and inuentions, which worke not with fire, at which arise (in respect of the meanes and instruments) from the former, and therefore, the generall of them all is called Ignimetallica, or Metall-organica, as was specified before.

## SEC. 10.

### METALL-ORGANICA

Metall-organica is an inuention Ignicke for the cheaper making, and acquireing of diuerse profitable, thinges, workes, and materials by the meanes of the Metallical instruments, fire, onely excepted, whereupon the things made and acquired by this art, are called Metall-organickes.

Metall-organica, comprehendeth many worthie inuentions whereof these seuen are principall, euery one of them making royalties a peece, excepting the wood-pleite art.

First, then there is a new art and Inuention Metall-organicke, with a chiefly, by meanes of plegnicke instruments, maketh a new kinde of water-milnes-wind-milnes, and winde water-milnes, for the grinding of



corne, tanners bark, brazill, for the sawing of woods, makinge of oyles, battering of Irons and Coppers, and for the tuckeage and fullage of wolen cloth, or yellow oyled leathers, or for any other use or purpose whatsoever, which other milnes are turned into ordinarily. And these Metal-organicke, milnes are less chargeable to make, set up, keepe and repaire, and yet more necessarie and coneuiant, then the ordinarie sort of milnes, which be now in use.

Secondly, there is another new art and inuention Metallorganicke, which chiefly meanes of Plegnicke instruments maketh also an artificiall kind of water after an easier order, then those that are already in use in the common-wealth.

Thirdly, there is another new art and inuention Metallorganicke, which chiefly by meanes of Plegnicke & Lenick instruments, ioyntly together, maketh singular effectuall, and most excellent deuices, and meanes for the dreyning and drying of marshes, fennes and low-grounds.

Fourthly, there is another new art and inuention Metallorganicke, which chiefly by meanes of Plegnicke and Lenick instruments, ioyntly together, maketh, singular, effectual & most excellent deuises & meanes, for the riding, clearing, and mounting of waters out of colepits & minerals, the like was neuer in use or practise before.

And here the Ballance engin made of press wares is of great and worthie good use.

Fifthly, there is another new art and inuention Metalorganicke, which chiefly by meanes of Plegnicke, Lenicke, and caminicke instruments, ioyently together maketh singular effectual and most excellent deuises for the fertilizing, hartening and improuing of pasture ground, corne-ground, and all other barren grounds whatsouer.

Sixthly, there is another new art and inuention Metallorganicke, which chiefly by meanes of the Plegnicke instruments maketh very effectuall and beneficiall instruments of fishing, as new kind of Burces, new kinde of Nettage and Bateage, by which new deuised meanes great aboundance of fish may be caught with farre lesse charges, and in a shorter time then by the ordinary arts of fishing.

Seuenthly, there is another new art and inuention, Metallorganicke, which chiefly by meanes of the Plegnicke instruments maketh diuerse kinds of household moueables, as artificcal Dore, Windowes, Curteines, Presses, Tables, Stooles, Bedsteads, Hangings, Chests, and diuers other things handsomer & more conuenient then heretofore is done by the ordinarie way of other stuffe.

Where note, that the materials made by this mechanicke art, are called wood-pleits.

And so forth, as it shall bee further mentioned in the Printed Treatise of Metallica.

### CAP. 3.

Heuretica defined and deuided into his reall and Tecknick parts.

R.

6. Sir, you hauing thus set downe both the Transcript of his maiestures Indenture and the Schedules annexed, I pray you to proceed more fully to entreat of the doctrine of Metallica which seemeth to be handled in the next place.

A It appeareth from the first section of the Schedules, annexed to the patent that the doctrine of Metallica cannot distinctly knowne or Methodically expressed except that the art which prescribeth precepts general to all arts and inuentions called Huretica, be first precognized.

R 7. Define therefore breefely Heuretica.

A Heuretica is the Art of inuentions, teaching how to find new, and to iudge of the old.

R 8. What deuision is there for Heuretica ?

A The doctrine of Inuentions hath two parts reall and Technick.

R 9. Define the real part ?

A Reall is the first part of Heuretica, which

heateth of the instruments and reall things which belong to the inuentions.

R 10. How is the reall part deuided ?

A The reall part spreadeth itself into two branches, whereof the first is called Organic, and the other Emporeuticall or Polecall.

R 11. Define the Organick part.

A The organic is a part of Heuretica, which setteth down the means and instruments, whereby the work of Art, intended, is brought forth, made and effected.

R 12. Define the Empoeruticall or Poleck part.

A The Emporeutick is an organick part of Heuretica which heateth of the worke of the art, which are commodities and wares for use and sale, whereby profit is raised where note the comodities, wares and things of euery inuention for generall use, are called from this part Emporeuticks..

Note also that Emporeuticks, being things artificial, are also fitly called materialls, but if they bee naturall, they are called thinges acquired by the art. So fish and fowle are the Emporeutick Materialls & made and wrought by Metallicque art.

R 13. Define the Technick part.

A The Technic is that habituall part of Heuretica which heateth of the dexterous habit and faculty wherewithall all the Artizands are to be quallified and

endowed, who are appointed to make the emporeutick workes of Inuentions.

## CAP. 4.

Another partition of Heuretica  
and an Inuention mechanick defined.

**R.**

14. What other diuision is there for Heuretica ?

A Heuretica in respect to the worke intended is diuided into two parts, namely, into the Scientiffick part and mechanick part.

R 15. Define the Scientiffick part.

A The Scientiffick is that part of Heuretica which prescribeth precepts generall to all liberall arts, the end of which arts is cheefe by a reall visible worke or sensible thing.

And the inuention in this kind is called an Inuention mechanick.

R 16. Define therefore an Inuention mechanick.

A A mechanick Inuention is the art of the Inuentor, which by effectuall Instruments and meanes bringeth forth some new visible or sensible worke good and profitable to the Common-wealth.

So the Inuention of Printing is the skill and art of Faustus Guttenburgius, which mistery (by the effectual deuised meanes of Presse, the Inke, the

characters and paper) bringeth forth impressions and Bookes, which mechanick workes are profitable and good for man's use.

Where note, that, First the mechanic art, secondly the instruments and meanes, thirdly the worke of the art, made by those Instruments, and meanes are called mechanicks, and all Inuentions in respect of the author that deuised them.

R 17. Expresse further euery word and clause of this definition, to the intent that I may the better understand them.

A Your desire shall bee satisfied. First then to speake of the thing defined, you must not that any other deuice, course, or way which bringeth forth no externall or materiall worke, are also in respect of the Inuentor tearmed Inuentions, so the first discovery of the West Indies by Columbus (in respect of him) is fitly called his Inuention, and the turning point of nauigation called the Cape of Bona Speranca is Gaymus his Inuention like may be said of Fretum Magellanicum, and Fretum Dauies, which although they are laudable Inuentions, discouered by ingenious & adventurous persons, yet cannot they be sad to be mechanicks, because the produce or leaue behind them mechanick work, nor had any mechanick instruments made by hands of man directly, and of purpose for the performance of them, for these mechanicks are onely proper to these kinde of Inuentions which we treat of.

R 18. Wherefore call you an Inuention a mechan-  
ick arte ?

A To put a distinction betweene these Inuentions  
mechanicall, and other Inuentions of the liberall Arts  
and Sciences, of which sort are Logick, Rhetorick,  
Grammer, and the mathematicall sciences, all which  
had their authours and Inuentors.

R 19. wherefore say you the art of Inuentioner ?

A To shew that there is no Inuention without  
relation to the Inuentioner.

R 20. Why then it seemeth that all arts, sciences,  
mysteries, trades, crafts, things and deuises, which are  
now extant in the commonwealth, are and may bee  
called Inuentions ?

A Yea verily so they may, if we respect the  
Inuentioner, and first authors of them, but if we  
respect the person who use and put in practize the  
said Inuentions, at the second hand as we say, such as  
are the Artificers, Tradesmen and others that make  
the said mechanic workes, in respect of these  
secondary persons they are called Arts, Trades, Crafts,  
Syences, Misteries, Occupations, Professions, and  
flightes &.

So the Printing, as also the Presse, the Paper, the  
Characters, together with the workes done, as impres-  
sions, bookes, and volumes in respect to Faustus are  
his Inuentions, but in respect of Printers, which now

a dayes worke by his inuention, Printing is rightly called an arte, trade or mistery, the like may bee said of all other mechanicall Trades now extant in the common-wealth, and of all other profitable Inuentions, which hereafter may be brought to light in the common-wealth.

R 21. To what use serueth the knowledge of this ?

A This fitly serueth to repute the erronious folly of such shallow simple persons, which cannot abide any new inuention, which this our age bringeth forth, they utterly distaste both the proiects and Inuentors, they forsooth (as they say) will giue no assistance, they will not meddle nor deale with them, they will not use their new worke, though neuer so good and profitable, nay they say more after their fond fashion, it will neuer prooue good or come to passe, with a hundred such like speeches tending to the despraise both of the Inuentioner, and of things deuised by him, but being demanded for their reason, they haue none to alleadge, except onely a womans reason like unto that of the Epigrammatist.

Non amo te volusi, non possum dicere quare,  
Hoc tantum possum dicere, non amo te.

But if these men, who so much spurne at Inuentions, did well consider that all ancient Mechanic trades, occupations, professions, trades, and workes,



which now are in use in the Common-wealth were new at the first, and had their beginning and infancy, and how they were then the peculiar inuentions of some ingenious wits, who trauelled with all their endenours to bring forth the said inuentions, to the good of that age in which they liued.

If I say they did well, consider and ponder this, they would not bee so auerse and bitter against laudable and good proiects, brought forth now a days, for which as good reason they might enueigh against printing, shipping, milning and buildings, against the ordinary waies of making of salts, alloms, coppresses, and saultpetre, against the trade and art of makeinge of hats, and knit-stockings, shoes, bootes, and apparell, against the arte and trade of making of saddles, cartes, ploughs, harrowes, and against the arte of melting, founding, and casting of mettles, of forging, hammering and battering of irons, brasse, pewters, siluer and gould ; and finally against all other trades, occupations, vocations, and proffessions in the common-wealth, as so basely to regard and esteeme the proffitable and new Inuentions of our daies.

Againe, in scorning and contemning profitable businesse of late inuention they set themselves not onely against man, but also against the Spirit of God who is the Authour of the said gifts, and first worke of them in man, as it is expressly taught in the 31 of

Exodus: in the example of two worthy Inuentioners, and artificers, the wordes of the text are these. Behold (saith God to Moses) I haue called by my name Bezaleele, the sonne of Vri, the sonne of Hur of the tribe of Iuda, whom I haue filled with the Spirit of God in wisdom, and in understanding, and in knowledge, and in all workemanship, to finde out curreous workes, to worke, in gould, in siluer, and in brasse. Also the arte to set stones, and to carrie in timber, and to worke in all manner of workemanship.

And behold I haue ioyned with him Aboliah, the sonne of Ahisamath of the tribe of Dan, and in the hartes of all that are wise harted, I haue put wisdom to make all that I haue commanded thee.

Out of which words of holy Scripture it is apparent that all mechanicke Arts and Inuentions, as well as the graces of salutation, are the peculiar workes, and gifts of Gods holy spirit in man, which bloweth where, and when he listeth, and powreth out his spirit, upon some men in euery age.

## CAP. 5.

Transient instrumentall  
meanes.

R 22. In the definition of the Organicke part you say that the worke is produced by instruments

and meanes, I would therefore know of you, how many kindes of instruments and meanes there are to effect a new businesse.

A The Organick things for the effecting of a new Inuention are of two sorts, Permanent or Transient.

R 23. Describe the Transient Instrument and meanes.

A Instruments and means are said to be transient, when in respect of their use, they serue but once for that imployment for which they were appointed, so fuell and oare are transient, because they wast and consume in that materiall which they make.

R 24. How many kindes are there of this transient sort.

A Two: Efficientiall, or materiall.

R 25. Describe the efficientiall Instruments.

A Efficientiall are such Transient Instruments and meanes as vanish and consume away in their first use, whilst they are performing their operation and efficiency to produce the pretended Mechanicke worke, as namely the fuell or fireing in euery businesse.

R 26. Describe the materiall Instruments.

A Materiall, are such Transient instruments and meanes whereof the instruments consist and made, not vading or vanishing away, but remaining transformed or altred in the substance of the thing, effected as namely the stuffe and matter of euery Mechanic instrument.

## CAPT. 6.

### Permanent Instruments & meanes

**R.**

27. I understand well the Transient instruments with their seuerall kindes, pray you describe the permanent.

A Instruments and meanes are said to be permanent when as they serue to perform their operations diuerse times (to wit) in this thing, in that thing, and in many others, of this sort are all tooles, in euery trade, all kilnes, furnaces, ovens, hearths, in euery trade. If we respect the first making and creation of permanent instruments, then must we consider their efficientall, and materiall meanes also.

R 28. How many kindes are their of this sort.

A Two, for these permament meanes, are either personal as either the workmen and artificers in euery action; or else impersonall, of which sort are all other instruments of the businesse.

R 29. How many sorts of workmen are there for euery Inuention?

A Two, primary and annuall, primarie as the Inuentioner to guide, and artifices to make, the annuall are the daily workmen which make the mechanicke.

R 30. How many artifices are necessarie for the primarie, and first foundation of mechanicke inuentions.

A These subsequents, are most necessarie, as namely; Ioyners, Carpenters, Smiths, Brickelayers, Masons, whereupon in seuerall inuentions, diuerse other Artificers are to be added, as occasion serueth, as Shoomakers, Glouers, Bellowes-makers &.

R 31. How many sorts of annuall workmen are necessarie for the yearly managing of an Inuention.

A Two, the maister and ouerseer, or his apprentices, or seruants, which make the mechanicke worke, and secondly the reparationers, which maintain and mend the instruments and meanes which at the first they made and formed.

R 32. What distribution haue you for impersonall Instrumnts?

A The impersonal instruments, are either generall or speciall, the generall is the workhouse where other instruments doe their operations, worke and employment, and under this head we Comprehend, the ground, place, yarde, or roome, where the mechanicke businesse is wrought or done. The speciall impersonal instruments besides the worke-house or place. Amongst which impersonal instruments furnacing may be briefly touched as being a necessarie instrument in most Inuentions.

R 33. How define you a furnace ?

A A Furnace is the artificiall receptacle, which beareth and containeth fewell and the fire.

R 34. How many kindes are comprehended under the head of furnacing.

A Diuerse, as namely all kindes of ouens, lampes, stoues, kilnes, hearthes, all which we generally comprehend under the head of Furnacing.

## CAP. 7.

Instruments and meanes procured and meerey operative, monies and charges of businesse.

R.

35. What other distribution haue you of instruments and meanes of a Busines, in respect of charges.

A Organicke meanes of a Mechanicke, are either procuring, or meerey operative.

The procuring meanes is monie to be impended and disbursed in Charges.

It is the instrument of instruments, and meane of meanes, procuring all other instruments and meanes meerey operative, and when once they are procured and provided by it, it measureth their worth and valuation, whereupon Aristole calleth it, " Communis mensura omnium."

R 36. What is generally to be knowne and

considered, concerning the monies to be disbursed in a busines.

A Monies, or charges of a Busines, are either primarie and once impended, or else annuall, and at certain times to be renewedd.

R 37. What differences are their of primary monies.

A Primary monies are either disbursements about the first foundation, or about the tryall.

R 38. What call you fundamentall charges.

A Charges of foundation are all such primary monies which are to be disbursed at the first erection, or setting up of a new businesse, or of grand Mechanickes, in some one conuenient place, whereby a worke-house is furnished with all permanent necessary tooles and instruments.

R What call you charges of Tryall?

A Charges of Tryall are the primary monies which are bestowed or disbursed about the tryall and an Experimenting of an inuention or new businesse.

R 40. Wherein consisteth the chief charges of tryall.

A The triall monies are to be disbursed first about the Theoricke instruments, and meanes of an inuention, that is the whole description of an Inuention. Whether it be by way of manuscript writings, or printed Treatises.

Secondly, about the moddles of an inuention, whether they be superficiall or reall, motionall or directionall.

And lastly about the erection and foundation of the Protoplast, unto which at the other grand Mechanickes are to be conformed.

R 41. Concerning the charge of Tryall, what is fittest for an Inuentioner to demand of them that are willing to deale in a new businesse.

It is the wisest, safest, and most credible course for the Inuentioner, not to aske under hand whereby he shall be driuen to repair to them againe the second time, but rather at the first let him aske and agree for monie, and not for lesse than will serue the turne.

R 42. What other chiefe rules ought an Inuentioner carefully to observe in the practise and tryall of any new inuention.

A That he may make triall and put in practise his new deuise and inuention with good successe and to purpose, let him alwaies well remember these subsequent rules.

1. Make things stronger then that Exact strength which the thing is to haue.

2. Make things greater then that exact greatnesse which the thing is to haue.

3. And therefore make things longer, broader, thicker and wider, then that Exact length, breadth, thickenesse and widenesse that the thinge is to haue.



4. Make more in number then that Exact number which is required to serue the turne.

5. Take longer time for a new busines then will serue the turne.

6. For qualities, as hardness, softnes, drinesse, moistness, stiffness, toughness, & obserue this Rule.

Let things be tempered to a greater quality than will serue the turne.

7. Yet if the Inuentioner can make the thing in the Exact truth, then let him do it accordingly, for this is always least chargeable.

R 43. In the first triall of things can the Inuentioner perfectly hit on the Exactnesse of Euery particular instrument and meanes belonging to the new businesse.

A The Vundertakers and dealers are to Expect some losse in triall of new businesse, be the Inuentioner euer so perfect in his Theorick; for although he does his best Endeauour, and giue perfect directions to his workmen and artificers, yet they will often faile and erre in their worke, by which meanes the instruments being experimented and put to triall, becometh insufficient, for the appointed use, and many times the Inuentioner in some one pointe may faile himself; for which their is no helpe but only to redresse and amend the fault in the instrument, or else to make a new instrument in the others stead, neither of which can be done but with further charge.

R 44. What call you the annuall charges of an Inuention.

A Annuall are such monies which from time to time upon occasion, are bestowed after the first Plantation upon the repairing, maintaining, and continuing the said primary instruments belonging to the said new businesse.

### CAP. 8.

Inuentions intermixt and pure, moddle Protoplast and grand Mechanick defined you haue handled the doctrine of the generall meanes and Instruments of Inuentions, proceed I to pray you to speake of the differences and diuers kindes of Inuentions, and first therefore I desire to know.

R 45. How many sorts or kindes of Inuention are there being compared or considered one with another?

A Two, An Inuention is Either pure or intermixt, an Inuention is said to be pure and entire within itself, when as none of the parts essentiall are common to any other Inuention for the same use.

Intermixt when as some of the parts are found in some other former Inuention. So a Windmill is an intermixt Inuention because some of the parts, as namely the Milne-stones, the ring-wheels, and the cog-wheels were first Extant in a water-milne, or Horse-milne and quernes.

But a hand-querne was a pure and simple Inuention, because none of the Essentiall parts thereof were taken from any former Inuention where they were applied to the same use.

Where none but common parts of an intermixt Inuention are to be esteemed as proper and peculiar to the same Inuention, when as they are conioyned and mixed in with other new things Instruments and meanes, which are the Essentiall parts of the new deuise.

R 46. What other distribution haue you of an inuition in respect of magnitude.

A In respect of greatnesse or quantity, there are three sorts of Inuentions, namely the moddle, the Protoplast and the grand Mechanick.

R 47. Describe the Moddle.

A The Moddle is a Mechanick, which onely representeth and decyfereth, in some little platforme, the true part and lineaments of the Mechanick inuention, beeing insufficient to yeeld any Emporeutick use of the Inuention.

So the moddle of a Wind-milne, representeth the sailes and the other part of the fabric and structure, but grindeth no corne.

Where note, that sometimes the moddle is to be made greater than Mechanick, especially in small curious things, and such like.

R 48. How many sorts of Moddles are there ?

A Two superficiall and real.

The superficiall describeth only the parts and lineaments in paper, bordes or past-bords by limning, drawing, or painting, shewing no action, or opperration : Neverthelesse it is not so effectual or fully vse-full being onely representatiue, as was touched before. So a little ship, which you haue hanging up in a Marchand's house, is the Reall moddle of a grand ship or sea vessell, because it representeth euery part and action thereof.

R 49. What is the principal use of a Reall Moddle ?

A. The cheefest use of a reall moddle is that the Inuention may thereby more perfectly and exactly both direct himselfe, and also guide his workmen for the finishing of any grander mechanick, of the same kind, thereby the better to produce and bring forth the Theorick conceiued in his mind into the grand Reall Inuention.

So the use of a small reall moddle of a Wind-milne serueth uery fitly to direct both the Inuentor himself and likewise all his Carpenters and other workment to proceed infallibly to build and set up a reall and grand windmillne intended to be made.

R 50. How many sorts of reall moddles are there ?

A There are two sorts, for either they are merely directionall or also motionall.

Directional is that moddle which is made only to guide the Artificer in the dimensions of all the parts, as also for to direct them for the kinds of the matter and the stuffe that they are to haue to make the engin intended.

R 51. What is the fittest and cheapest stuffe to make a directionall moddle of.

A Past-boordes and reedes are the fittest either for Iron-works or woodworks, whereof the Past bords are instead of boordes, planks and bed-sides.

And the reeds are the fittest to represent round Cy-lindriack timber, as also other square timber, as name-ly single quarters, double quarters, puncheons, rafters transummes &.

So that of these the Inuentioner may fitly and speedily make and construe the fabricke and structure or any directionall moddle.

R. 52. What call you a motionall mooddle.

A. A motionall moddle is that moddle Real which is made compleat in euery part, hauing his true use operation and motion, as in the grander Menchanicks yet hauing no Emporeuticke commodity, but onely for shew and tryall, and not for sale and use.

There are three degrees in this motionall moddle the meane moddle, the lesser than the meane, the greater than the meane. The meane moddle is a motionall, which hath has his magnitude and greatnesse betweene

the other extreames, being the least chargeable to be made. And it is always greater than the lesser motionall: and there is but one meane modle to be found in the progressio of the same degrees.

Where note that it belongeth principally to the Inventioners skil and care to set forth the dimmensions and parts of his moddle, intended with the least expence of charges that may be, and in the easiest and rediest manner for his workmen to understand and imitate, or else he hitteth not upon the meane moddle, but on some other extreame.

R Define the Protoplast.

A The Protoplast is an Inuention Mechanick which is first set up of that kind, and seruing to profitable Emporeuticke uses, hauing all the principall parts, actions and perfections, which all other subsequent grand Mechanicks ought to haue of the same kinde, which afterward are to be made and framed by it.

So the first windmill the Inuentioner euer set up to grind corne was the Protoplast and example from whence all other wind-milnes sprang and were deriued, the like may be said of euery kinde of Mechanicke, as of Faustus his first Printing Press &

R Define a grand mechanicke.

A The grand mechanicke, is that which is set up after the form and tipe of the Protoplast in greatnesse, or with some profitable additions which later experience has taught.

So the Windmilnes in Moorfields are mechanicks of that kind of Inuention, for they are builded after the Archetype of the Protoplast which the inuentor first inuented and erected, seruing to the same use of grinding corne; they differ onely in this, the haue a deuise called the Crampe, which will sodenly (in the face of the storm) the violent motion or circumgyration of the wheeles, untill the sales are taken downe or fardled up.

## CAP. 9.

Inuentions Heterocresious and Homocresious primitive, and deriuatiue, defined.

## Reader.

55 What other distribution haue you of a Mechanick inuention, considered one with an other.

A Inuentions considered comparitiuely one with another, haue two diffirences, for they are eyther Heterocresious, or else Homocresious.

Heterocresious, are inuentions which produce different mechanick workes, warres and commodities. So milning and shipping are two Heterocresious inuentions, because the worke of the one is meale or flower, and the worke of the other is carriage or transportage.

R Define Homocresious Inuentions.

A Homocresious inuentions are such which produce and bring forth Emporeuticall workes for the same use.

So a horse-milne, a water-milne, a wind-milne are Homocresious, because they all grinde flower, though after different manner and ways.

R 57. What distribution haue you for Homocresious.

A An Inuention Homocresious, is either primatiue or deriuatiue, the primatiue is that which was the first in use in the world, of the same kinde.

So a pestle and a mortar is a primatiue intention, because it was first used to bruze corne into meale and powder, and at this day it is still used to grind oaten-grotes, but a hand querne, a hors-milne a wind-milne, and a water-milne, are inuention deriuatiue, all which were found out in succession of time, long after the pestle and the mortar.

R 58. Giue some other illustrious examples of primatiue and deriuatiue inuentions.

A In matters of literature, the art of writing with the pen, is a worthy primatiue inuention, both for writing and reading, found out by Moses, that Learned Leuite and thrice holy Prophet, the deriuatiue inuention, whereof is Printing, a far more exquisite misterry deuised of late years by Faustus Guttenbergius.

So in husbandry the spade, the rake and shouell,



was a worthy primatiue inuention of Adam, for the tillage and sowing of the ground, according to that ancient and old prouerbe.

When Adam digged and Eue span,  
Who was then a Gentleman.

But the Plough and the Harrow are their deriuatiue iuentions, which for their uses of husbandry doe farre exceed them, for by them more worke of tillage of the ground may be done in one day with the same charge, then could be done by their primatiue inuentions in twenty dayes.

Againe the Barrow which carrieth burdens from places is a primatiue inuention but the cart with wheels is a far more excellent deriued Mechanick, because it carrieth more in one day, then the primatiue can doe in ten dayes with the same charges.

And this Inuention of round wheels to draw and carry loades with a small strength vndoubtedly was grounded on this Geometricall axiom, *Circulus tangis planum vinico puncto*—for if the wheeles should haue beene made square, trencher fashion, or in any other poly-angle, forty-horses would not so easily draw them being laden, as two doth now with both speed and ease. And thus much for the example of primatiue and deriuatiue Inuentions.

Where note that the deriuatiue must always be of a greater use, and doe more good in the Commonwealth

then the primatiue, or else it is not to be receiued.

Note also, if there be many deriuatiues<sup>r</sup> in the same kinde, the latter inuention must alwayes better the former, and being all of them compared and rancked with their primatiue they make an Inuentionall progression, one exceeding an other in goodnesse and use, amongst which, the last of all ought to be the best, and is therefore called the Eumechanick in the progression of that kinde.

R 59. Giue some examples of Inuentionall progression.

A I will satisfie your desire, and first in matter of husbandry, for the making of bread which maintaineth the life of man, there is a progression of these fīue Inuentions, First the mortar, secondly the hand-querne, thirdly the horse-milne, fourthly the water-milne, fiftly the winde-milne.

To which if we adde the inuention of the Plegnick milne, it maketh up the sixt and is the Eumechanick of that kinde.

Secondly in hose and stockings, there is a progression of three, cloth or kersey stockings with needles: Thirdly, and lastly, in knit stockings with loome, which is a late Inuention of one Maister Lee.

Thirdly, in vessels of drinking there is a large progression. For first to pretermitt the cup of the hand, out of which Adam and Gedeons three hundred

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soldiers dranke Judg. 7. 6. There is secondly the Eathern Pitcher, which the Samaritine woman had at the Well: and the third roome came up the use of the Black Leather Iacks, an ancient drinking vessell of our natiue countrymen, and the fourth place sprung up the use of Tankards and Wodden Kans, in the fift out of hornes, in the sixt Siluer, gould greene-glasse, Venice-glasse and Peuter.

All inuentions, for the most part, of latter times, are deriuatiue, & the Inuentioners are to make choice of this kinde, and needeth the lesse to spend his time about any p[er]petiue deuiice

**CAP. IO.**

Inuentions organicall and emporeuticall :  
The parts and adiuncts : The Theoricke  
and practicke of an Inuention Organical.

**R.**

60. What other distribution is their of an inuention Mechanicke.

A. An Inuention Mechanicke, in respect of use is either organicall or emporeuticke commodities.

So the windmill considered with himselfe is the compact, study, or fabrice, which comprehendeth all permanent instruments and meanes which produce, yeeld and bring forth meale or flower.

But the flower and meale thuse made and ground by the Windmillne Engin is fitly called the inuention emporeuticall.

So likewise the whole structure and complement of all the permament, and impersonall instruments, and meanes which made up the Fernical Furnace, is termed the inuention.

R 61. What differences haue you for the parts of an Inuention Organicall.

A. The parts of an inuention organicall, are either essential or inessential, comon or peculiar organicall.

But the Earth-coal iron which is made by the said

complement, and panoply of instruments is fitly called the emporeuticall inuention of the Author or Inuention.

R 62. Describe the essentiall parts of an Inuention organically.

A. The essential part of an inuention organically is any maine and chiefe member, whereby the Engin is well enabled to performe his worke and operation which being lacking, the other parts of the Engin become ineffectual, and inoperative, for the producing of the emporeuticke intended.

So a windmillne consisteth of all his essential parts besides his crosse sales is ineffectuall and not able to grinde corne, the like may be said if it lacke a cog-wheele, a ringe-wheele, a milne-stone, or any other essentiall part.

R 63. Describe an inessential part of an Inuention.

A. An essential part is an additament which indeed somewhat bettereth and helpeth the Inuention when it is added to the maine complement of the Machin or Engin, yet being lacking and not used, it taketh not away the operation or worke of the Inuention or Engin: of this sort is the crampe of a windmilne, which is a very and worthy addittament, found out by some ingenious Milner of late, and it is able to hold the cross sales immoueable, euen in the very blast of a storme.

Yet wind-milnes which had not nor haue not this later addition of the crampe doe daily grind corne as well as other windmilnes which are therewithall furnished.

But in a storme they are driuen to this inconuenience that three or foure must presently goe down to turne their crosse sails out of the winde, that they may take downe and fardle up the sailes.

So likewise the brasse plate and the rowling girth are necessarie and conuenient additions in the Engine of the Printing Presse, and both of them were of late years first deuised (as it said) by one Maister Haruie an ingenious Printer in London yet before they were added or used in the mistery of Printing, Faustus his inuention was absolute and compleat of it selfe.

R 64. Describe the common parts of an inuentionall Organicall.

The common parts are such as are borrowed from other trades, occupations and misteries formerly inuented and in use, and now adioyned and mixed in, amongst the newest parts of the inuention.

R 65. What call you the peculiar parts of an inuention.

A The peculiar parts are such as are proper and of the essence of the inuention, not being taken from any other Mechanicke formerly in use.

So the sayles, the milne-post, the spurs of a wind-

milne are his peculiar parts, but the cogge-wheeles, ronge-wheels and milnestones are common parts as being assumed and from the horse-milne and water-milne formerly in use.

R 66. What difference haue you for the adiuncts of an inuention Organically.

A The adiuncts of an inuention Organically haue the same differences, which the parts of an inuention had before.

For the adiuncts are either essential or inessential common or peculiar, the nature and distinction of which differences may be easily conceiued and understood by the descriptions of the former seuerall parts.

R 67. What other differences haue you for the adiuncts of an inuention Organically.

A The adiuncts of an inuention Organically are also necessarie or lesse necessarie.

Necessary adiuncts are all such which necessitie are to be used for the producing of the intended Mechanicke.

And the lesse necessarie are all such which brings some small helpe to bringe forth the Emporeuticke.

R 68. What distribution haue you of an inuention Organically.

A An inuention is said to haue a Theoricke or a Practicke.

R What call you Theoricke Inuention.

A The Theoricke of an Inuention is the declaration of the contents thereof by a plaine and familiar discription, and that either by manuscript writings or by printed treaties.

R 70. What arguments are cheefe for the description of an inuention.

A The arguments of the parts and adiuncts, or the arguments of instruments and meanes.

R 71. Do the parts and adiuncts, and instruments, and meanes, expresse diuers meanes.

A No, for by parts and adiuncts are understood the selfe same things which are meant by instruments and meanes, but yet in diuers and different respects: for they are called parts and adiuncts in respect that the Mechanic Engin subsisteth & consisteth of them, but in respect of the Emporeutick, which is made by them, the said parts and adiuncts are fitly called instruments and meanes.

So a Printing Presse hath his seuerall parts whereupon doth consist, as the screw, the nut the pear-tree and the chase &. it hath also his adiuncts belonging to it, as the Inck and the Inck-balls &. which said parts and adiuncts of the Presse considered, with the printed papers bookes and impression which are the saleable emporeutick workes. I say in this respect they are called Instruments and meanes whereby printed Bookes are attained to.



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R 72. Define a practick of an Inuention.

A. The practick of an Inuention is that which is made in reall parts and adiunct according to the description of the Theorick of an inuention.

So if you describe an iron furnace by euery part and adiunct which belongeth thereunto, such a discription is called the Theorick of a Furnace, but afterward if you make a real furnace of moddle, stuffe, or of bricke, clay or earth according to the discription & Theorick proportions, then such a furnace is called the practik of a Furnace, the like may be said of any other Mechanick or Engin.

R 73. What cannons haue you of an inuention in respect of the Theorick.

A. The Theorick of an Inuention is to be described by his parts and adiuncts that other mens labours and indeaours bee incroached vppon or forestalled thereby.

## CAP. II.

An Inuention triable and untriable  
conformable and inconformable, Royall  
and Coppy-hold.

R.

74. What other kindes or sorts haue you of an Inuention.

A. An Inuention is two fould, An Inuention of discouery, or an inuention of experiment, or an inuention is triable or untriable.

R 75. A triable Inuention is an inuention whose worth and goodnesse cannot certainly appeare before trialls and experiments bee made, not only in the moddles thereof, but also in the Protoplast it selfe.

Of this sort are all the Inuentions Metalllicall comprised in the Patent and also the inuention called the Register for general commerce.

R 76. Define an inuention vntriable.

A An vntryable inuention is a new proiect or discouery, whose worth and goodnesse requireth no tryalls, but may be iudged and discerned onely by the discription or declaration of the plot and proiect.

Of this sort are all Monopolies, new customs, imposts, taxes, subsidies, statutes, with fines, and diuers other state businesses, discoueries and inuentions, which are ordinarily propounded or petitioned of his Maiestie.

Of this sort is Spherica, a late inuention of the Authours, the proiect and contents whereof shall be handled in a treatise called Spherica.

R 77. How many sorts of tryable inuentions are there.

A. An inuention tryable is either conformeable or inconforemable.

R 78. Define a conformeable inuention.

A A conformeable inuention is an inuention tryable which reformeth and bettereth a former inuention on (requiring but some small and not chargeable alteration) after that the new is united to the old.

So the iron furnaces, fineries and chafferies may be much reformed and bettered with small charges, hauing our Ferrical inuention vnited to them, and therefore the Ferrical inuention is fitly called a conforemable Inuention.

R 79. What cannons or rules have you for a conformeable inuention.

A Conformeable inuention being priueledged is farre more beneficiall and commodious to the Patantees & the dealers in that busines, than an inconformable inuention and the reason is because that immediately after the grand tryals are brought to passe and performed in the Protoplast, they may choose whether they will be at any further charge, and yet they may raise present rent and benefit by conforming of the former inuentions of the Protoplast, and not at theirs, but onely at the charges of the ownners of former works and inuentions.

R 80. Define an inconformable inuention.

A An inuention is said to be inconformable whose Protoplast being erected and set up, cannot be conformed to any former intention in use, where by

yearely profits of conformity may be raised without charges to the Patantees and dealers.

So the presse ware inuention maketh tiles and brickès and all other clayworks, after a farre more ganeful and beneficiall manner than by the ordinary course, yet nevertheless it is an inconformable inuention, because that the ordinary arts of tilemaking and brickmaking cannot be conformed unto the Presse war Protoplast with some small alterations and small charges.

R 81. What cannons or rules haue you of an inconformable inuention.

A An inconformable inuention requireth a great stocke and great disbursements from the Patentees to lay out aswell for the Protoplast as also for some two or three grander mechanicks thereof

Secondly an inconformable inuention after the erection and perfection of the Protoplast in continuance of time may raise great rents and fines by licences, leases and deuices though by no present conformity.

R 82. What other distribution haue you for an inuention mechanicke.

A An inuention Mechanicke is either priuiledged or unpriuiledged, againe, it is either a Royaltie or a Copey-hould.

A Royalties is such a new Businesse which in the

greatnesse thereof belongith peculiarly to the King.

Or a Royaltie is an Inuention mechanicke which produceth extraordinarie and worthie yearely profits and reueneries, whose valuation exceedeth the summe of Ten thousand pounds—per annum.

R 83. Define a Coppy-houlde Inuention.

A Coppy-houlde is an Inuention whose yearly valuation and worth exceedeth not the sum of 10-000.

84. What cannons or rules haue you concerning of Royall or Coppyhould Inuentions.

A These Cannons belong to a Royall inuention, first no subiect or subiects of what estate or degree soever by his seruice or demerit except the Queene mother, the Kings children, is capable of a whole entire Royaltie, and therefore if the King have passed away a Royaltie, ignorantly, he may iustly recall and reuoke his graunt.

Secondly a subiect may be his seruice to his Prince and Country demerit part or portion of a Royaltie, it being no greater than a Copy-hould.

R 85. What Cannons or Royalties belonging to a Mechanicall Inuention should be priuledged for a certain time wholly to the Inuentioner and Author, if so it but of the yearly value of Copy-houlde.

Secondly, the first Inuention of a Royaltie though of meane degree hath as great demerit in the Inuen-

tion, as any other subiect of what Estate or degree soever, excepting Royall persons.

R. 86. What Cannons or Rules haue you concerning Royalties.

A There are diuers other rules and observations which I spare to speak of at this time, because at further leasure I purpose to print a little Tractate of Royalties and Coppy-houldes which is a parcel of this Treatise of Metallica.

## CAP. 12.

Cannons or Rules seruing to iudge of the goodnesse of a deriuatiue Inuention Emporeuiticall.

R.

87. How may those who are willing to deal in the triall of new Inuentions iudge of their goodnesse.

A There are many infallible rules by which a deriuatiue Inuention be examined, we may easily iudge of the goodnesse thereof, but to reduce this doctrine to some head, we are to consider both the generall vertues, and generall faults in inuentions.

R 88. What are the generall vertues by which an Inuention is to be examined.

The vertues of an inuention are of two degrees, the lesser and the greater, and each degree is threefold.

R 89. Which are the lesser vertues of a deriuative Inuention.

A These three Equi-sufficiencie, Equi-cheapness, Equi-excellency.

R 90. What mean you by Equi-sufficiencie.

A Equal-sufficiencie is when the new Inuention or Emporeuticke is as sufficient and as good for use as the ould.

So printed bookes are as sufficient and as good to read as written Inuentions, and the Meale grinded by the windmilne, is as good and sufficient to make bread as that which is grinded by the water-milnes and earthen pipes by the Pressorean Art being well made are as strong to hold and conuey water as leaden pipes or potters pots, which two kindes of water conueiances werein use long before presseware pipes were inuented.

R What meane you by the second vertue which is called equi-cheapnesse.

A The new Emporeuticke is said to haue equi-cheapnesse, when it may be sould and uttered as cheape as the ould commoditie or Inuention which was in use before.

So if Printing bookes be but as cheape to be sould as M.S. books, then they are said to haue equi-cheapness.

And if tiles made by the Pressorian art may be afforded to be sould and uttered as cheap as the tiles

made by the ould and ordinarie way, then the Pipe-ware Tiles may well be said to have equi-cheapnesse with ordinarie Tiles.

R 92 What meane you by the third vertue which is called equi-excellency.

A The new Inuention is said to haue equi-excellencie with the ould, when it hath in it the same beautie and perfection that the ould commoditie of sale hath, and in the same degree measure and equalitie.

So if Muscovie glass be as cleare, transparent as greene glasse for windowes, then in regard, then in regard of the beautie and perfection of the substance it is said to bee Equi-excellent.

R 93. Which is the greater virtues of an Inuention.

A There are three, more sufficiency, more cheapnesse; more excellencie, all which are easie to be understood by their lower degrees described as before.

R 94. Which are the lesser faults of an Inuention.

A There are also there, insufficiency, exceeding-dearnesse, exceeding baseness, ugliness or ill-fauourednesse.

R 96. What Cannons or Rules haue you to iudge of a deriuatiue Inuention by comparing these virtues and faults together.

A There are many, whereof these following serue to iudge of their unworthinesse.



R 97. What is the first Cannon.

A If an Emporeuticke haue only in it all the smaller virtues, although it may be esteemed commendable for a new inuention, then surely it will do no good to be set up and followed.

So if any clay-worke made by Presse-ware art, as namely, tile, slate, free-stone, paving-stone archage & or greene-glasse made by Sea-cole, if these two new inuentions fal out to bee but Equi-sufficient, Equi-cheape, and Equi-excellent with old inuentions of tiles, slates, free-stone paving-stones, archage, then surely there will be no good to be done by them, because they yield no good to the Commonwealth.

R 98. What is your secret cannon to iudge of the worthlessnesse of an Inuention.

A If a new Inuention of sale haue in it but all the smaller faults, it is not to be commended proue good, for example, if one should devise a water-worke, to raise waters, which is lesse sufficient for that purpose, and more chargeable to be erected, and in regard of excellency more imperfect then the ordinarie raising of waters in use, I say such an Emporeutick is to be iudged a worthlesse Inuention.

R 99. What is the third directory cannon.

A. If a new inuention, compared with the old, be found to haue in it but one of the grander faults, although it be accompanied with some one or two of

the grand virtues, yet is it to be reiected for starke naught, for there can no good be made of it, for instance sake that one hath deuised to make windowing of the pure mettle of Venice-glasse, or of the pure substance of Christall, which is not impossible to be done, This his sale Mechanick will be exceeding deere and costly, And therefore although it be more excellent or stronger, or more sufficient then the ordinary kind of windowing by greene-glasse, yet the Inuentioner will neuer do good of it, except it bee to beggar himselfe, and all that shall deale in it: for, a scrap of Coloquintida, I say, marreth a whole mess of good pottage.

R 100. How many directory triplicities is there of this Rule.

A. There are,

First exceeding deerennesse, more sufficiency, more excellency.

Secondly insufficiency, more cheapnesse, more excellency.

Thirdly unsightly basenesse, more sufficiency, more cheapnesse.

This last triplicity although it hath two grand virtues, yet the buyers of this Emporeutick will not deale with it, because they cannot abide to behold it.

R 101. What other triplicities are there of this cannon.

A. Three, one grand vertue, and three by another which for breuities sake I omit.

R. 102. What other cannons haue you to iudge of the worthlessnesse of an Inuention.

A. If an Inuention containe all the grander vertues, and yet tend to the utter confusion of Kingdoms and ciuill estates, then is it by no meanes to bee attempted or enterprized by any Inuentioner, of this kind is the Inuention to walk invisible—if such a deuise may be attained unto, to make a barge or ship to flye as well in the ayre as to saile upon the water.

R. 103. What cannons or rules haue you to iudge of the goodnesse and worth of a deriuative inuention.

A. There are many cannons likewise for this purpose, all which are grounded on triplicities of the former vertues of lesser faultes, or intermixt of both.

R. 104. What is the first cannon.

A. An Inuention that hath none of the grand faults and hath at the least one of the grand vertues, or more in his triplicity, then is to be esteemed good and valuable as it appeareth by at these subsequent triplicities.

R. 105. R. Recite the triplicite of this cannon.

1. A. More sufficiency, Equi-cheapnesse, Equi-excellency.

As for example, earthen, tileage is more sufficient and durable, equi-cheape, and equi-excellent then the

old way of couering of houses by wooden pannels, when wood and timber were then as plentiful in England as is now in Virginia or new found land, and therefore a very good inuention.

2. Equi-sufficiency, more cheapnesse, Equi excellency.

3. Equi-sufficiency, Equi-cheapnesse, more excellency.

4. Equi-sufficiency, more cheapnesse, lesse excellency.

5. Lesse-sufficient, more cheape, Equi-excellent.

Of this sort is—Lees Inuention of loome stockings and the tillage of ground by plough and harrow comparing it with Adams old tillage with spade and iron-rake, which Garderner's still use.

6. More sufficiency, Equi-cheapnesse, lesse excellency.

7. More excellency, lesse-cheapnesse, Equi-excellency.

8. Equi-sufficiency, lesse cheapnesse, more excellency.

9. Lesse sufficiency, Equi-cheapnesse, more excellency.

10. More sufficiency, more cheapnesse, equi-excellency.

11. More sufficiency, more cheapnesse, less excellency.

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12. **Equi-sufficiencie, more cheapnesse, more excellency.**

13. **Less sufficiencie, more cheapnesse, more excellency.**

14. **More sufficiencie, Equi-cheapnesse, more excellencie.**

15. **More sufficiency, lesse-cheapnesse, more excellency.**

16. **More sufficiency, more cheapnesse, more excellency. Which is the best and most eminent of all other triplicities.**

**Metallicall Instruments defined with their seuerall  
kindes. Lenicks, Presse-wares and  
mouldes described.**

## **Reader.**

106. The Manuscript Treatise on schedules annexed to the Identure, as it seemeth, comprehendeth many worthy matters and excellent inuentions, but it is somewhat obscure and obstruce, both by reason that some points are implicately set down, and also in respect of some strange and hard words which I doe not perfectly conceiue or understand: I pray you therefore enlarge and describe the same Materiall points, in a more familiar phrase and stile, that such plaine men as myselfe, who are willing to deale and aduenture in these your inuentions, may more fully understand the purport and goodnesse of your businesse.

A. Sir you neede not be offended with the scholasticall tearmes, for it hath alwaies beene lawfull to the Authours of new Arts and inuentions at their owne pleasure to giue names to their new arts, instruments and deuises which are not so vulgarly knowne. Goe but to a Printer and you shall heare many strange words of his inuention and misterie, as namely—Charrecters, the Composer, the Long Primer, the

Pica, the Italica, the Chase & the like tearmes you shall finde in diuerse other trades in London.

I hope therefore I shall not be barred or denyed of that libertie of making choice of words of Arts, for new matters which is giuen and allouend unto euerry tradesman in own scyence and mistery.

Indeede I confesse that some points are more closely and briefly touched of purpose and the reason was, because I had often promised to explaine and illustrate them in the printed treatise, and it would haue bin both tedious and more chargeable to haue drawne the manuscript in a prolix and ample sort.

Neuerthelesse to the intent that no iust exceptions may be taken, & that the meanest capacitie may perceiue my meaning, I will be ready to explaine and amplifie the seuerall contents of my Pattents in as plaine and easie manner as I can think or deuise.

R 107. It is euident by your Pattent, that all Mechanick Artes and Inuentions which performe their worke by the help and operation of Metallicall Instruments, are all of them pruiledged businesses vnto you. Wherefore I pray you describe at large all the sorts of Metallicall Instruments and meanes, which are the strength, nerues, and sinews of your pruiledge.

A. The instruments and meanes Metallical which are used for producing the Metallique Materialls or

things are (as it was shewed before) of two sorts, common and peculiar.

The Common Instruments are such which are borrowed from other trades, occupations and mysteries amongst which wee haue especially the use of Smithes, Ioyners, Turners, not onely of their instruments and tooles, but also of their Emporeuticks which they ordinarily make as Presses, Vices, Screws, Bellowes, Tongs & made either of iron and wood, or of both together.

R 108. What call you the peculiar Metallick Instruments.

A. The Peculiar Instruments are those that are of the Authors Inuention, being of chiefe and principall vse for the working of Metallick effects, when they are used and conioyned with other Common Instruments, and they are of two sorts, Principall; and lesse principall.

The principall are those which in the manuscript are called by the names of Legnick, Plegnick & Camminicks.

R. 129. Define the Metallick Instruments, which are called by the name of Lenicks.

A. The Lenicks are peculiar Metallick instruments, which worke their operation and effect, by pressing, impressing, impresioning or moulding, and that either by thrusting or drawing.



R. 110. What call you the Emporeutick materials which are made by these Lenick Instruments.

A. The materials that are made and brought forth by these pressing & moulding instruments, are called Press-wares or mould-wares.

R. I pray you set downe the definition of Presse-wares or Mould-wares together, with their seuerall sorts or kindes.

Presse-ware or Mould-ware, is any thing that can bee made, wrought, or formed of clay, earth, not by hand and the round table, as the Potters use, nor after the common manner of tile-making and Brickmaking but by presse and mould, or by pressing and moulding.

There bee many sorts or kinds of Presswares by reason of different figures, and diuerse uses unto which they are to bee applied, all which kinds are reduced to these two heads: Rude-ware and Pollishtware.

#### Rude-ware.

Rude-ware are such sort of Presse-ware which after they are pressed and moulded, require no further ornament.

Pipeage is the principall branch of Press-ware, and it is nothing else but the making of earthen pipes, for the conducting and sweeter conueighing of fresh waters for the seruiceable vse of houses.

Field-pondage, is a kind of Pipeage, which from

higher springs and fountaines conueigheth and distributeth water into seuerall pastures closes and fields, and in euery one of the said places, maketh and leaueth a pond of water for cattle and beasts to drink in, this kinde is very necessary for Country Townes, where there are but some few springs, and many hundred of inclosed pastures, which in the heate of Summer want waters.

And Kennelage is one of the chief kind of Pipeage which passeth and voydeth away the stincking and filthy waters of citties and Townes under earth into the common ditches or sewers, and this kind is very necessary for the auoiding of noysome and infectious ayres, expecially in the heate of Summer.

Of Press-wares also are made Pumpes, as sufficient as Lead or Wood, and farre lesse chargeable.

Welleage is a kind of Presseware for the speedy making of Wells, farre cheaper than the rounds, which are made of Brick to keepe the earth from falling downe,

Priuy Funnels or Vaults, may also be made by the Presse-ware Art so close and so sweete that there can be no annoyance or unsauory smels euapoure out or presse through them. This kind of presse-work is very necessary for many houses in the citty, which are much annoyed by the leaking and sincking through the funnels of Brick.

As Walls are made of ordinary Bricks, so may they be made of Press-wares more handsome, cheaper and dureable. •

Open Gutters are made by the Press-ware way, which may serue betweene houses instead of Lead, or in fields to conduct and lead away water, or on the eues of houses or Pent-houses. •

The Press-ware Art, ministreth a kind of Tiling and slating for the couering of houses more substantiall and dureable then those that are made by the ordinary way of Tiling, or then those blew and hewen slates which are digged out of the Slate Quarries.

Spouts ordinarily are made of Lead, and hanged on the outside of the walls, but Spouteage may more conueniently be made of Pipes, brought downe within the middest of the Brick Walls, for to conueigh raine water into the sincks vnder the earth. •

#### • Polisht-ware.

Polished-ware, are such sorts of Presse-wares, which after they are pressed and moulded, receiue further ornament and beauty, by Turners, Ioyners or Engrauers tooles, or by Turning, Planing, or Engraving and there are three degrees of this ornament, for else it is meerely by cutting off the edge, when the Presse-ware of clay is liuer dry, or else by repressing againe which is when they Presse-ware is figured or

fashioned the second or third time with the mould againe. The third degree is by fire, colouring, which is the glaring glazing or leading of Presse-ware, this addeth a super-excellent grace and lustre to the worke, if it be well and curiously done and performed, and it hath in it this singular prerogative. For whereas freestone greeneth presently with the first wet and raine, and after in continuance of time becometh owergrowne with mosse, or else moulteth, or cometh away, but this sort of Polished ware continueth alwaies in his native and lively hue, neuer tainting or altering with any weather, no more than the stone Iugs or Cruses, which we usually drink out of.

Of Pressewares also we may make all kinde of pauing-stones larger and greater than those which are made by Potters and Tilers, which kind is very serviceable for pauing of houses, galleries, ouens, courts, and furnaces.

Fish Ponds may be both floored in the bottome and wainscotted on the sides by the Presse-ware Art, so sufficiently, that neither the earth can fall downe, nor the ouse or mudd to swell vp within. So likewise for bathes and baynes.

Spouts ordinarily are made of leade, and hanging on the outsides of the wals, but they may be made of turned pipes being also beautified with glazing, leading, or other ornaments, stamps, or impressions.

The like may be said of Windowing and Monions for windowes, which may be made and cast of white clay, as sufficiently and substantially as of hewn bricke or Free-stone, Gardens, Squares and Walkes are usually compossed and inuironed with railes and pales of wood or stone, this may also be done by Press-ware, cheaper, stronger and handsomer.

In a word there is no part or appurtenance in buildings, which is made either of bricke, tile, lead, wood, Tarras, or freestone which cannot more conueniently be made by the pressing art of casting, and the reason thereof is, because that mouldes may be made to cast all kinde of solid shapes, figures, and bodies whatsoever.

So that from hence also we make Bullets, Globes, Coping stones, Archings, Pillars, Columnes, Finishings, Chimneys, Flannels, Mantletrees, or Clauels for chimnies, Cesternes, Coppers, to brew in, Wainescotting for chambers, and such other like things, and vtensils.

R 112. What are the generall and chiefe instruments of making Presse and mould.

R 113. How many kinde of Presses or Pressing Instruments are there.

A Pressing or impressioning of things is performed by diuers meanes, as namely by beating, stamping, knocking, or falling.

Secondely by screwing or viceing. Thirdly by the

drawing of flexible girths or cordes. Examples of all which sorts, are to bee seene at my worke-house at Highbury, in the parish of Islington neere London.

R. What call you a moulding instrument, mould or moulder.

A. A Mould or Moulder, is an Artificiall instrument which mouldeth, figureth, and, proportioneth the tempered earth, which being forced, passeth thorough the mould.

R. 115. How many sorts are there of mould or moulders.

A. Moulds are of two sorts, for two they are as long as the Press-ware, which they make and figure, of which sort all those which are called by the names of scouring mouldes at the worke-house at Highbury, or else they are shorter than the Presse-wares which they make, whereupon they are called—Short Mouldes.

Diuers sorts both of long mouldes and short mouldes, are to be seene at the said workhouse, and therefore I will not further enlarge or describe them heere, but referre the Reader to see them at the place aforementioned.

R. 116. When a presse and a short mould are in one frame united together, what is the fittest name to call that instrument by.

A. It may aptly in a word be called a Presse-mould which is further described and handled in the next chapter.

**CAP. 14.**

The Press-mould: and the Plegnick  
Instruments defined.

**R.**

117. Describe therefore the Press-mould by his end and use.

A. A Presse-mould is a pressing and moulding Instrument for the making of all kind of Press-wares, that is to say, all kind of tiles, bricks, and paving-stones, furnace stones, or any kind of clay-work or tempered earths whatsoever.

118. R. Describe the Press-mould by his parts and adiuncts.

A. The Presse-moulde consisteth of these general parts.

1. Two clay-boxes
2. Two Receipt Boxes
3. One Screw
4. Two Pressours
5. Foure Anti-pressoires
6. Two Nutboxes
7. Two squeeze tables
8. Two Coane spits
9. Two Screw posts
10. Frames for the said parts
11. Driers and Rammers, which are adiuncts.

There are many sorts and differences of Presse-moulds, eury sort consisting of different parts and adiuncts, all which shall be at large described in the second edition of Metallica, or in the appendix, or edition unto this treatise called Pressoria.

In the meanwhile if any be desirous to see both this Presse-mould, Engin and the working thereof, at High-bury and at Islington, he may haue diuerse sorts of them, which in an Artificial manner doe make all kinde of Clayworks with extraordinary speed and readinesse.

R. 119. I understand what you meane by Lenicke Instruments, I pray show what use they haue in Iron businesse.

A. First, the Lenick Instruments serue very fitly for the tempering, stamping, and comixing of Sea-cole or Stone-cole, that a kinde of substance being there made of them like unto past or tempered clay, the Presse-mould may form, and tranfigure that clay-like sustance into hollow pipe-cole as it doth earthen-pipes.

Now this pipe-coal is of very good use for the making and working of some kind of iron and steeles.

Secondly the Lenicke Instrument serueth very fitly for the breaking and bruising, stamping and beating, tempering and impastening of all kind of iron oares, whereby they are prepared for the Furnace in a very beneficiall manner and course, for when this impasted oare is by the Engin of the Presse-mould Intubated and



formed into pipes, as if it were clay or loame, These Oare pipes being made hollow and full of holes are sooner melted and consumed by the heate of the furnace and with farre smaller charges of fewell or firing then the ordinary oare which Founders put into their furnace in peeces or gobbits as great as wallnuts.

R. 120. You hauing handled sufficiently the doctrine of the Lenickes or Pressing Instruments, I pray you proceed and shew me what you meane by Plegnickes, which your Manuscript maketh the second kinde of your Metallicall Instruments.

A. Plegnicks and Metallicall Instruments which perform their operation and effect by means of their dexterous and artificiall ioynt-mouing.

R. 121. How many kindes of Plegnicke instruments be there.

A. There are fve kindes of Plegnicke Engins or Machins, the Plegnicke Bellowes, the Plegnicke Milne, the Plegnicke Schrew, and the Plegnicke Rombus, and the Reciprocall Plegnicke.

R. 122. What odds and prerogatiue differences is there betweene the ordinary Bellowes (which Smiths and Mettal-founders daily use) and your new deuised Plegnicke bellowes.

A. There are many differences, first the Plegnicke bellowes is more handsomely and strongly made, than ordinary and refining bellowes, and with farre less

expense of leather, for here the leather is not closely nailed upon the wood but strongly grafted and incorporated into the very substance of the timber, so that by this meanes the ioyting of the leather and the wood together, is as thite and close as the substance of the boords themselves.

Secondly the Plegnicke Bellowes may bee made to blow and streame forth not only could wind and ayre (which is all that ordinary bellowes can doe) but also to blow and send forth flames of fire, vapours and dust, all of which is very necessary for the blowing of Metallique substances, as shall be at large shewed in the second edition or in the appendix called Plegnica.

Thirdly the Plegnicke bellows may be so made and contriued, to blow ten times more than the ordinary bellowes, and that either by moouing ten times faster, or else by being made ten times greater.

R. 123. What odds and prerogatiue differences is there betweene the ordinary Milnes and your new deuised Plegnick Milnes.

A. The Plegnicke Milnes haue many prerogatiues and conueniences which the ordinary Milning lacketh : and to begin with the Windmilne.

First the ordinary Windmilne hath not only his sails mounted up in the wind, but also the workhouse wherein the milne-stones and the cogge-wheels grind the corne, by which meanes they are subiect to bee

blowne down with storms, but the Plegnicke-milne hath his workhouse upon the firme ground, by meanes whereof you may make your Roomes as wide and as large as you will without any hazard or danger of blowing downe.

Secondly the cross sails of the windmilne doe mooue verte caliter, as they cal it, or thorough the zeneth or the nader; whereuppon ariseth this inconuenience that the Windmilne must be turned and haled about continually as the wind changeth but the Plegnick Wind-milne hath his crosse-sails ouer the top of the Workhouse, and they flye round about with a circular motion, paralel to the Horizon, whereby it is ready for all windes without turning or haling about.

Thirdly this Plegnick deuise may be made to go with three or foure paire of Milne-stones at once, whereas the wind-milne can go only but with one paire, and by this meanes the Plegnicke-wind-milne will grinde three or foure times more meale in an houre, especially in a good gale of winde.

Fourthly the Windmilne grindeth only corne, and cannot be made to doe any other worke, as the water milne doth, but the Plegnick engine doth all manner of workes, it will grinde corne as well as the wind-milne, it will serue for the iron-furnace to blow the bellowes as well as the ordinary Water-milne or Horse-milne doth.

Fiftly the wind-milne standeth still in a calme and when the wind serueth not, it is made to goe with horse, and in a small gale of wind the horse may help to draw and mooue it faster.

Sixtly there are also many other conueniences in the Plegnick Water-milne ouer and aboue the ordinary water-milne as more at large shall be shewed in the second edition of this treatise.

R. 124. How many sorts of Plegnick milnes are there in regard of the force that moueth the Engin.

There are fiae sorts of Plegnick milnes, the first is called the horsewin because it moueth both with horse and wind, the second kind is called the Horsewater because it goeth both by horse and water, the third kind is called the Windwater, because the wind and the water mooueth the Engin ioyntly together.

The fourth is called the Horswinwater because it is mooued with horse, wind and water alltogether and at one time. The fift kind is called the Water Plegnick which mooueth either inuisibly and secretly under the water and by the water with one rong wheel or elce with two Horizontall wheeles aboue the water.

R. 125. Did you euer make any of these Plegnicke milnes to experiment their goodnesse by triall.

A. I haue made diuers milne engins to go both by wind and water, in the moddle, but not in the grand Mechanick, and I haue at this present a horsewin now

framing at Highbury, which the God willing shall stand upon some Turret in London neere unto the Thame's side, where all passengers by water may see it goe and mooue continually. I haue also at Pickle-herring ouer against the Tower a water legnick which mooueth only by the water, and goeth very swift with two paire of milne-stones, whosoeuer is desirous to see it may haue it there at a shipcarpenters yard upon the wharfe. And thus much of the Plegnicke milne.

R. 126 Define the Plegnick Screw, the Plegnick Rhombus, and the Reciprocal Plegnick, which are the three last kinds of your Plegnick Engins.

A. The Plegnick screw is an engin whose spirall line mooueth with one motion, two vice nuts or matrixes at the same time, which no other screw did before. This Plegnick Screw is very auaileable in Metallicall workes, aboue any other ordinary screw, which hath beene usually in the commonwealth, but especially it is very conuenient for tumbering, beating and impas-tening of all kind of oares and pitcoles.

The Plegnick Rhombus is an engin of extraordinary and admirable power and faculty, and in regard of quick and speedy motion there was neuer any Machin yet deuised, which cometh neere unto it.

The Reciprocal Plegnick is an engin that hath wheels running reciprocally, turning backwards and forwards by one great wheele that moueth but one

way at the same time which kinde of reciprocal motion was neuer done or performed before by any other engin.

This reciprocal is of great use for the battering of Iron, latten, plate, copper, or any other mettles. If any be desirous to be further certified concerning the truth of these admirable motions, operations and workes of these three Engins, let them repair to Highbury, and it shall be evidently shewed and demonstrated unto them, in diuers reall moddles and examples.

## Cap 15.

**Caminicke instruments, as  
fewels, liquours and  
furnaces defined.**

127. Haueing described the Lenicke and Plegnicke instruments, I pray you proceed to the third kind of Metallicall instruments, which you call by the name of Caminicks.

A. Caminicks are peculiar Metallical Instruments which performe their operation and effect by their new kind of furnacing and hearthing.

R. 128. How many kindes of Caminicke instruments be there which serueth for the making of all kinde of Irons and other mettles and materials.

A. There are three kindes, the fewel, the liquor and the furnace.

R. Define fewell.

A. Fewell is any substance combustible being apt or fit to burne, or to make, or to take fier.

R. 130. Rehearse the seuerall kindes and sorts of fewell.

A. There are three sorts of fewell, whereof fier is made: wood-fewell, which is either charcoal or unburnt wood-fewell. Secondly Pit-coal or Earth-coale, and thirdly Brush-fewel.

Char-coal is the Principall and best for use, but by reason of scarcity it is grown very deare in our country.

Earth-cole is that kinde of fewell of firing which is digged out of the bowells of the earth, of which sort also there are many kindes hauing difference in their burning. The Scottish coal is the best flamer, and consumeth away into white ashes, as hauing in it more vnctiousnesse than sulpharousnesse. The New-Castle-coale vsually called Sea-coale, is more lasting and dureable then the Scottish, for being sturred up it will make a secondary or third fire, whereas the Scottish-cole consumeth at once; For which cause all Brewers and artificers of London rather than use this sort. Houbeit it is not so fit for some metallique purposes by reason of the more aboundant heauy sulphurous substance remaining in it.

Turffe and Peate maketh a thirde kinde of earth-coale, and if they haue any sulpharousnesse in them, it is not so heauy and fretting as that which is in the Sea-coale and Stone-coale, the Low Counties use for the most part this kinde of fewell, instead of wood and sea-coale.

Brush-fewell is the third kind of firing which is neither of the inward substance of the earth, nor of the upper superficies as Sea-coale and Turffe is, but growing upon the earth in a brushie or twiggie manner, of this sort is all kinde of stubble, Baueings, straw, Furs,



Fearne, Ling, Heath, with other stalkes, of hearbes, weeds and under shrubs, all which burne with great flames, yet they are of no great heate or long continuance. Vunder bush fewell, we comprehended also another sort, which is not so much used for firing, as for lights, as namely, oyles, tallows, waxes, which are used in lamps and candles. Secondly, pitch, rosen, turpentine, tarre, mastick, with such like liquids and gums, as issue and proceed from trees being combustible. This kind of fewell is most fit for the Ventignoll Mechanick, which hath good and profitable use for the many purposes, where other fewell is not so fit.

R. 131. What meanes are to be used to make Earth-coale as seruiceable for metalique purposes, as wood or Char-coal.

A. There are three sorts, the first is to bring earth coal to that equality of heat, that wood or charcoale hath, that is to say, that it maketh neither hotter or colder fire than wood or charcoale doth: the second meanes, is so to order and prepare pit-cole, that all nocure proprieties, which are aversse from all Metalique substances may be abstracted in it. The third meanes is the addition and infusion of those deficient properties, which as they are in charcoal, so are they to be found in pit-coal.

A. By Caminick liquores, I understand divers

kinds of intermixt and compounded waters for the lauing, washing, and steeping of all kind of mettle Eures to cause them the better to keeld and giue downe their liquid mettle from their slagges and cinders. So that as the Goldsmith hath his waters which will segar gould from siluer, and the Allum-maker his mines for the seganing and bringing downe of his. So these Caminicke-liquoures are very behoofeffull and effectfull for the steeping and tempering of oares, which being thereby prepared, they will the more easily let down their pure mettle being seuered and abstracted from the excrement and drosse of the cinder and the slagg.

R. 133. Define a Furnace.

A. A Furnace is a Caminicke instrument made and built of furnace earth; or a furnace is the Artificiall receptacle of fier and fewell, for boyling, nealing, and backing of all kinde of Raw-materials or Rawe-matters.

R. 134. How many kindes of raw matters, are there for furnaces to worke upon.

A. There are five sorts of Rawe matters, the mettle-matter, the liquor matter, the fiery earth matter, the dry matter an compounded matter.

R. 135. Describe more plainly these seuerall kinds of Rawe matters.

A. The Mettle matter is that metallar substance

which is put into the Furnace to be baked, boyled, or nealed, which in one word may be called the Metellar.

R. 136. How many kindes of Metellars are there.

A. There are three sorts of Metellars.

The first is the raw or baked oare as it is digged out of the Earth, which being put into the Furnace melteth down into two substances, the one is called the Glasse-slage is a liquid materiall of a glassie substance, being tough, thicke and ropie like bird-lime, it swimmeth upon the superficies of the soure liquour, as barme doth upon beare, or creame upon milke.

The second kind of Metellar is the sowe of iron which when the hearth or furnace hath receiued it, it melteth downe into two substances whereof one is called Ferrica Substantiæ, as whey doth in a posset, or crudds.

The Ferrica substantiæ is tougher then the liquor of the alter-slagg, which when it is battred under the stroke and presse of the hammer, the after slagge is squeezed and pressed out, and so the substance is made and becometh good Iron, euen as the whey is wrung out by the violence of the Presse, and so the cruds are made into a cheese. .

The third kinde of Metellar is the could Iron, which when the fordge, furnace or hearth receiueth it, it is healed and heated into glowing iron afterward is forged by the Smith into diuers Emporeutickes for many-fould

uses and purposes, as namely into kniues, horse-shoes, Iron-weapons, windowe barres, windowe casements, and into a thousand little Emporeuticks, whereby Smiths get their liuing and maintenance.

R. 137. In the defenition of your Furnace, you make mention of Furnace-earths, I pray you what meane you by them.

A. Furnace-earth is any earthy substance beeing made and prepared of stone, clay, lime, so that it may become the fit and sufficient matter for the Caminick Furnace.

R. 138. How many kindes of Furnace-earths are there where-withall you build up your Furnaces.

There are three sorts of Furnace earths. The first is the clay-pipes made of white-clay; being tempered, wrought and inpastned with the dust and pouders of diuers other things. The second kinde of Furnace earth, is the clay clammy mortar, which is of the same substance and temper that the clay pipes are. The third kind of Furnace earth, is the Furnace-stone, which is made into diuers figures and proportions by the Presse mould Art, and of the same matter that the other two kinds were made of before.

R. 139. Define the second kinde of Rawe matters which you call the liquor matter.

A. The Liquor matter is any kind of liquor or liqueable, whether it be cold or hot, which is put into

the furnace, Pot, Kettle, Cauldron or Copper to be further heated, and boyled, as namely all kinds of fatts, tallows, oyles, and all kindes of waters, whether simple or compound, as Fresh-water, Sea-water, Allom's-water, Coppresse-water, and a thousand such kindes of liquours.

R. 140. Define the third kinde of Rawe-matters which you call fiery-earths.

A. Fiery earth is any kind of earth or earthy substance besides the Mettlar which before was described, as namely all kind of Raw Presse-wares and burnt earths, before they are burned, baked or nealed, neuertheless the rawe oare if it be but nealed or baked belongeth to this kinde.

R. 141. Define the fourth kind of Raw matters which you call dry matters.

A. Dry-matter is any kind of Rawe-matter besides the three former which were described before, under this head we comprehended all kinde of pastes for bread, malts, saffrons, papers wet cloathes, &.

R. 142. Define the fift kinde of raw matter which you call compounded matter.

A. Compounded matter is any two or more of the former kindes comming and issuing from one furnace and from one fire, together, and at the same time.

R. 143. Hauing thus handled and discribed the seuerall sorts of Raw matters, which are the things that the stomack of the Furnace worketh upon, to bouring

to digest boile, and concot them, I pray you now proceed to the distributions of the Furnace.

A. The Furnace in respect to the seuerall kinds of Raw matters which it boileth and baketh, is likewise of fine sorts and kinds, namely

The Mettallar-furnace heateth, melteth & nealeth all kind of metallers, and so worketh them into their Emporeutick Materialls, under this head is comprehended all kind of iron-furnaces or hearths, for any other kind of mettles.

The descriptions of the other foure kindes of furnaces may easily be gathered by this, and therefore I referre the further explication of them until some other time.

R. 145. What odds and perogatiue differences are there between the ordinary furnaces which refiners and mettle founders daily use & your new deuised caminick furnaces.

A. There are many differences both in regard of the forme & figure of making of them, as also in respect of other conueniences and prerogatiues, whereof these are principall.

1. Our Caminick Furnace is made and built up of such dureable Furnace matter, and continually maintained with such fier-resisting meanes that it cannot possibly melte or burne downe by any reuerberating flames or heates whatsoever.

2. Secondly, our Caminick Furnace is alwayes built

with some moueable part, as namely the dores. Fewelbeare, matter-beare and the Ashe-beare, or any other part as wee please.

3. Thirdly our Caminick Furnace is built up with glasse windowes for euery seuerall roome, so that thereby the Furnar may continually see and behold his Rawe-matters and his Emporeutic Materials, and how his fire and Furnace worketh upon them which is a singular conuenience which our ordinary Furnaces want. These forenamed differences and conueniences with many others, shall be truly shewed and demonstrated in the seuerall examples of our Caminick Furnaces, which verry shortly (God willing) shall be raised and built up at Highbury & Islington.

R. 146. What and how many are the generall parts of your furnace, which are to be found in eury kind of your Camin.

A. These fiue, the dores, the windowes, the fewell bear, the matter-beare, and the ash-beare.

1. 2. The dores are to shut and open, and so are also some of the windowes.

3. The matter-beare, is a generall part of the Furnace which beereth and holdeth the substances of the Raw-matters.

4. 5. The Fewell-beare, is a generall part of a Furnace which beareth and holdeth the fewell and fire and the Ashbeare beareth the ashes.

R. 147. What and how many are the rooms of Furnace which are to be found in euery kind of your Caminicks.

A. There are foure seuerall rooms, which are to be found in euery Furnace, the ashe roome, the Fewell-roome, the fewel, and firing. The matter room receiueth and holdeth the raw-matter. The lower vent-holes let out the smoak.

R. 148. Hauing thus described your three principall Metallcall Instruments called by the names of Lenicles, Plegnicks, and Caminicks, I pray you describe your other Metallcall Instruments which you called before the less principall.

A. There are indeed diuers other Metallcall Instruments which are proper and peculiar of the Authors Inuention, all which shall be shewed and described unto you in the second edition.

R. 149. To what end and purpose do you publish the treatise of Metallica in print, which describeth and discouereth all the cheefe instruments of your Inuentions.

A. There are diuers reasons which mooued the Author to describe publiquely to the view of the world these his Metallcall arts and Inuentions.

First that it might appeare that his inuentions are new and of his own deuising, and not stolne from any other.